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THE PRINCIPLES OF MATHEMATICAL PHYSICS.[1]

WHAT is the actual state of mathematical physics? What are the problems it is led to set itself? What is its future? Is its orientation on the point of modifying itself?

Will the aim and the methods of this science appear in ten years to our immediate successors in the same light as to ourselves; or, on the contrary, are we about to witness a profound transformation? Such are the questions we are forced to raise in entering to-day upon our investigation.

If it is easy to propound them, to answer is dfficult.

If we feel ourselves tempted to risk a prognostication, we have, to resist this temptation, only to think of all the stupidities the most eminent savants of a hundred years ago would have uttered, if one had asked them what the science of the nineteenth century would be. They would have believed themselves bold in their predictions, and after the event, how very timid we should have found them.

Do not, therefore, expect of me any prophecy; if I had known what one will discover to-morrow, I would long ago have published it to secure me the priority.

But if, like all prudent physicians, I shun giving a prognosis, nevertheless I cannot dispense with a little diagnostic; well, yes, there are indications of a serious crisis, as if we should expect an approaching transformation.

[1]An address delivered before the International Congress or Arts and Science, St. Louis, September, 1904. Translated by George Bruce Halsted.

We are assured that the patient will not die of it, and even we can hope that this crisis will be salutary, that it was even necessary for his development. This the history of the past seems to guarantee us.

This crisis in fact is not the first, and for its comprehension it is important to recall those which have preceded it.

Mathematical physics, we know, was born of celestial mechanics, which engendered it at the end of the eighteenth century, at the moment when it itself attained its complete development. During its first years especially, the infant resembled in a striking way its mother.

The astronomic universe is formed of masses, very great without doubt, but separated by intervals so immense, that they appear to us only as material points. These points attract each other in the inverse ratio of the square of the distances, and this attraction is the sole force which influences their movements. But if our senses were sufficiently subtle to show us all the details of the bodies which the physicist studies, the spectacle we should there discover would scarcely differ from what the astronomer contemplates. There also we should see material points, separated one from another by intervals, enormous in relation to their dimensions, and describing orbits following regular laws.

These infinitesimal stars are the atoms. Like the stars properly so called, they attract or repel each other, and this attraction or this repulsion directed following the straight line which joins them, depends only on the distance. The law according to which this force varies as function of the distance is perhaps not the law of Newton, but it is an analogous law; in place of the exponent -2, we have probably a different exponent, and it is from this change of exponent that springs all the diversity of physical phenomena, the variety of qualities and of sensations, all the world colored and sonorous which surrounds us, in a word, all nature.

Such is the primitive conception in all its purity. It only remains to seek in the different cases what value should be given to this exponent in order to explain all the facts. It is on this model that Laplace, for example, constructed his beautiful theory of capil-

larity: he regards it only as a particular case of attraction, or as he says of universal gravitation, and no one is astonished to find it in the middle of one of the five volumes of the *Mécanique céleste*.

More recently Briot believed he had penetrated the final secret of optics in demonstrating that the atoms of ether attract each other in the inverse ratio of the sixth power of the distance; and Maxwell, Maxwell himself, does he not say somewhere that the atoms of gases repel each other in the inverse ratio of the fifth power of the distance? We have the exponent -6, or -5 in place of the exponent -2, but it is always an exponent.

Among the theories of this epoch, one alone is an exception, that of Fourier; in it are indeed atoms, acting at a distance one upon the other; they mutually transmit heat, but they do not attract, they never budge. From this point of view, the theory of Fourier must have appeared to the eyes of his contemporaries, to those of Fourier himself, as imperfect and provisional.

This conception was not without grandeur; it was seductive, and many among us have not finally renounced it; they know that one will attain the ultimate elements of things only by patiently disentangling the complicated skein that our senses give us; that it is necessary to advance step by step, neglecting no intermediary; that our fathers were wrong in wishing to skip stations; but they believe that when one shall have arrived at these ultimate elements, there again will be found the majestic simplicity of celestial mechanics.

Neither has this conception been useless; it has rendered us an inestimable service, since it has contributed to make precise in us the fundamental notion of the physical law.

I will explain myself; how did the ancients understand law? It was for them an internal harmony, static, so to say, and immutable; or it was like a model that nature constrained herself to imitate. A law for us is no more that at all; it is a constant relation between the phenomenon of to-day and that of to-morrow; in a word, it is a differential equation.

Behold the ideal form of physical law; well, it is the law of Newton which first covered it; and then how has one acclimated

this form in physics; precisely in copying as much as possible this law of Newton, that is in imitating celestial mechanics.

Nevertheless, a day arrived when the conception of central forces no longer appeared sufficient, and this is the first of those crises of which I just now spoke.

What did one do then? One gave up trying to penetrate into the detail of the structure of the universe, to isolate the pieces of this vast mechanism, to analyse one by one the forces which put them in motion, and was content to take as guides certain general principles which have precisely for object to spare us this minute study.

How so? Suppose that we have before us any machine; the initial wheel work and the final wheel work alone are visible, but the transmission, the intermediary wheels by which the movement is communicated from one to the other are hidden in the interior and escape our view; we do not know whether the communication is made by gearing or by belts, by connecting-rods or by other dispositives.

Do we say that it is impossible for us to understand anything about this machine so long as we are not permitted to take it to pieces? You know well we do not, and that the principle of the conservation of energy suffices to determine for us the most interesting point. We easily ascertain that the final wheel turns ten times less quickly than the initial wheel, since these two wheels are visible; we are able thence to conclude that a couple applied to the one will be balanced by a couple ten times greater applied to the other. For that there is no need to penetrate the mechanism of this equilibrium and to know how the forces compensate each other in the interior of the machine; it suffices to be assured that this compensation cannot fail to occur.

Well, in regard to the universe, the principle of the conservation of energy is able to render us the same service. This is also a machine, much more complicated than all those of industry, and of which almost all the parts are profoundly hidden from us; but in observing the movement of those that we can see, we are able, aiding ourselves by this principle, to draw conclusions which remain

true whatever may be the details of the invisible mechanism which animates them.

The principle of the conservation of energy, or the principle of Mayer, is certainly the most important, but it is not the only one; there are others from which we are able to draw the same advantage. These are:

The principle of Carnot, or the principle of the degradation of energy.

The principle of Newton, or the principle of the equality of action and reaction.

The principle of relativity, according to which the laws of physical phenomena should be the same, whether for an observer fixed, or for an observer carried along in a uniform movement of translation; so that we have not and could not have any means of discerning whether or not we are carried along in such a motion.

The principle of the conservation of mass, or principle of Lavoisier.

I would add the principle of least action.

The application of these five or six general principles to the different physical phenomena is sufficient for our learning of them what we could reasonably hope to know of them.

The most remarkable example of this new mathematical physics is, beyond contradiction, Maxwell's electro-magnetic theory of light.

We know nothing as to what is the ether, how its molecules are disposed, whether they attract or repel each other; but we know that this medium transmits at the same time the optical perturbations and the electrical perturbations; we know that this transmission should be made conformably to the general principles of mechanics and that suffices us for the establishment of the equations of the electro-magnetic field.

These principles are results of experiments boldly generalised; but they seem to derive from their generality itself an eminent degree of certitude.

In fact the more general they are, the more frequently one has

the occasion to check them, and the verifications, in multiplying themselves, in taking forms the most varied and the most unexpected, finish by leaving no longer place for doubt.

Such is the second phase of the history of mathematical physics and we have not yet emerged from it.

Do we say that the first has been useless? that during fifty years science went the wrong way, and that there is nothing left but to forget so many accumulated efforts that a vicious conception condemned in advance to non-success?

Not the least in the world.

Do you believe that the second phase could have come into existence without the first?

The hypothesis of central forces contained all the principles; it involved them as necessary consequences; it involved both the conservation of energy and that of masses, and the equality of action and reaction; and the law of least action, which would appear, it is true, not as experimental verities, but as theorems and of which the enunciation would have at the same time a something more precise and less general than under their actual form.

It is the mathematical physics of our fathers which has familiarised us little by little with these divers principles; which has habituated us to recognise them under the different vestments in which they disguise themselves. One has compared them to the data of experience, or has seen how it was necessary to modify their enunciation to adapt them to these data; thereby they have been enlarged and consolidated.

So one has been led to regard them as experimental verities; the conception of central forces became then a useless support, or rather an embarrassment, since it made the principles partake of its hypothetical character.

The frames have not therefore broken, because they were elastic; but they have enlarged; our fathers, who established them, did not work in vain, and we recognise in the science of to-day the general traits of the sketch which they traced.

Are we about to enter now upon the eve of a second crisis? These principles on which we have built all are they about to

crumble away in their turn? Since some time, this may well be asked.

In hearing me speak thus, you think without doubt of radium, that grand revolutionist of the present time, and in fact I will come back to it presently; but there is something else.

It is not alone the conservation of energy which is in question; all the other principles are equally in danger, as we shall see in passing them successively in review.

Let us commence with the principle of Carnot. This is the only one which does not present itself as an immediate consequence of the hypothesis of central forces; more than that, it seems if not to directly contradict that hypothesis, at least not to be reconciled with it without a certain effort.

If physical phenomena were due exclusively to the movements of atoms whose mutual attraction depended only on the distance, it seems that all these phenomena should be reversible; if all the initial velocities were reversed, these atoms, always subjected to the same forces, ought to go over their trajectories in the contrary sense, just as the earth would describe in the retrograde sense this same elliptic orbit which it describes in the direct sense, if the initial conditions of its movement had been reversed. On this account, if a physical phenomenon is possible, the inverse phenomenon should be equally so, and one should be able to reascend the course of time.

But it is not so in nature, and this is precisely what the principle of Carnot teaches us; heat can pass from the warm body to the cold body; it is impossible afterwards to make it reascend the inverse way and re-establish differences of temperature which have been effaced.

Motion can be wholly dissipated and transformed into heat by friction; the contrary transformation can never be made except in a partial manner.

We have striven to reconcile this apparent contradiction. If the world tends toward uniformity, this is not because its ultimate parts, at first unlike, tend to become less and less different, it is because, shifting at hazard, they end by blending. For an eye which

should distinguish all the elements, the variety would remain always as great, each grain of this dust preserves its originality and does not model itself on its neighbors; but as the blend becomes more and more intimate, our gross senses perceive no more than the uniformity. Behold why, for example, temperatures tend to a level, without the possibility of turning backwards.

A drop of wine falls into a glass of water; whatever may be the law of the internal movements of the liquid, we soon see it colored of a uniform rosy tint and from this moment, one may well shake the vase, the wine and the water do not seem able any more to separate. See, thus, what would be the type of the reversible physical phenomenon: to hide a grain of barley in a cup of wheat, this is easy; afterwards to find it again and get it out, this is practically impossible.

All this Maxwell and Boltzmann have explained; the one who has seen it most clearly, in a book too little read because it is a little difficult to read, is Gibbs, in his *Elemetary Principles of Statistical Mechanics.*

For those who take this point of view, the principle of Carnot is only an imperfect principle, a sort of concession to the infirmity of our senses; it is because our eyes are too gross that we do not distinguish the elements of the blend; it is because our hands are too gross that we cannot force them to separate; the imaginary demon of Maxwell, who is able to sort the molecules one by one, could well constrain the world to return backward. Can it return of itself? That is not impossible; that is only infinitely improbable.

The chances are that we should long await the concourse of circumstances which would permit a retrogradation, but soon or late, they would be realised, after years whose number it would take millions of figures to write.

These reservations, however, all remained theoretic and were not very disquieting, and the principle of Carnot retained all its practical value.

But here the scene changes.

The biologist, armed with his microscope, long ago noticed in his preparations disorderly movements of little particles in suspen-

sion: this is the Brownian movement; he first thought this was a vital phenomenon, but soon he saw that the inanimate bodies danced with no less ardor than the others; then he turned the matter over to the physicists. Unhappily, the physicists remained long uninterested in this question; one concentrates the light to illuminate the microscopic preparation, thought they; with light goes heat; thence inequalities of temperature and in the liquid interior currents which produce the movements of which we speak.

M. Gouy had the idea to look more closely, and he saw or thought he saw that this explanation is untenable, that the movements become more brisk as the particles are smaller, but that they are not influenced by the mode of illumination.

If then these movements never cease, or rather are reborn without cease, without borrowing anything from an external source of energy, what ought we to believe? To be sure, we should not renounce our belief in the conservation of energy, but we see under our eyes now motion transformed into heat by friction, now heat changed inversely into motion, and that without loss since the movement lasts forever. This is the contrary of the principle of Carnot.

If this be so, to see the world return backward, we no longer have need of the infinitely subtle eye of Maxwell's demon; our microscope suffices us. Bodies too large, those, for example, which are a tenth of a millimeter, are hit from all sides by moving atoms, but they do not budge, because these shocks are very numerous and the law of chance makes them compensate each other: but the smaller particles receive too few shocks for this compensation to take place with certainty and are incessantly knocked about. And behold already one of our principles in peril.

We come to the principle of relativity: this not only is confirmed by daily experience, not only is it a necessary consequence of the hypothesis of central forces, but it is imposed in an irresistible way upon our good sense, and yet it also is battered.

Consider two electrified bodies; though they seem to us at rest, they are both carried along by the motion of the earth; an electric charge in motion, Rowland has taught us, is equivalent to a current; these two charged bodies are, therefore, equivalent to two parallel

currents of the same sense and these two currents should attract each other. In measuring this attraction, we measure the velocity of the earth; not its velocity in relation to the sun or the fixed stars, but its absolute velocity.

I well know what one will say, it is not its absolute velocity that is measured, it is its velocity in relation to the ether. How unsatisfactory that is! Is it not evident that from the principle so understood we could no longer get anything? It could no longer tell us anything just because it would no longer fear any contradiction.

If we succeed in measuring anything, we would always be free to say that this is not the absolute velocity in relation to the ether, it might always be the velocity in relation to some new unknown fluid with which we might fill space.

Indeed, experience has taken on itself to ruin this interpretation of the principle of relativity; all attempts to measure the velocity of the earth in relation to the ether have led to negative results. This time experimental physics has been more faithful to the principle than mathematical physics; the theorists, to put in accord their other general views, would not have spared it; but experiment has been stubborn in confirming it.

The means have been varied in a thousand ways and finally Michelson has pushed precision to its last limits; nothing has come of it. It is precisely to explain this obstinacy that the mathematicians are forced to-day to employ all their ingenuity.

Their task was not easy, and if Lorentz has gotten through it, it is only by accumulating hypotheses. The most ingenious idea has been that of local time.

Imagine two observers who wish to adjust their watches by optical signals; they exchange signals, but as they know that the transmission of light is not instantaneous, they take care to cross them.

When the station B perceives the signal from the station A, its clock should not mark the same hour as that of the station A at the moment of sending the signal, but this hour augmented by a constant representing the duration of the transmission. Suppose, for

example, that the station A sends its signal when its clock marks the hour o, and that the station B perceives it when its clock marks the hour t. The clocks are adjusted if the slowness equal to t represents the duration of the transmission, and to verify it, the station B sends in its turn a signal when its clock marks o; then the station A should perceive it when its clock marks t. The time-pieces are then adjusted. And in fact, they mark the same hour at the same physical instant, but on one condition, which is that the two stations are fixed. In the contrary case the duration of the transmission will not be the same in the two senses, since the station A, for example, moves forward to meet the optical perturbation emanating from B, while the station B flies away before the perturbation emanating from A. The watches adjusted in that manner do not mark, therefore, the true time, they mark what one may call the *local time,* so that one of them goes slow on the other. It matters little since we have no means of perceiving it. All the phenomena which happen at A, for example, will be late, but all will be equally so, and the observer who ascertains them will not perceive it since his watch is slow; so as the principle of relativity would have it, he will have no means of knowing whether he is at rest or in absolute motion.

Unhappily, that does not suffice, and complemetary hypotheses are necessary; it is necessary to admit that bodies in motion undergo a uniform contraction in the sense of the motion. One of the diameters of the earth, for example, is shrunk by $\frac{1}{200\,000\,000}$ in consequence of the motion of our planet, while the other diameter retains its normal length. Thus, the last little differences find themselves compensated. And, then, there still is the hypothesis about forces. Forces, whatever be their origin, gravity as well as elasticity, would be reduced in a certain proportion in a world animated by a unform translation; or, rather, this would happen for the components perpendicular to the translation; the components parallel would not change.

Resume, then, our example of two electrified bodies; these bodies repel each other, but at the same time if all is carried along in a uniform translation, they are equivalent to two parallel currents of the same sense which attract each other. This electro-dynamic

attraction diminishes, therefore, the electro-static repulsion, and the total repulsion is more feeble than if the two bodies were at rest. But since to measure this repulsion we must balance it by another force, and all these other forces are reduced in the same proportion, we perceive nothing.

Thus, all is arranged, but are all the doubts dissipated?

What would happen if one could communicate by non-luminous signals whose velocity of propagation differed from that of light? If, after having adjusted the watches by the optical procedure, one wished to verify the adjustment by the aid of these new signals, then would appear divergences which would render evident the common translation of the two stations. And are such signals inconceivable, if we admit with Laplace that universal gravitation is transmitted a million times more rapidly than light?

Thus, the principle of relativity has been valiantly defended in these latter times, but the very energy of the defence proves how serious was the attack.

Let us speak now of the principle of Newton, on the equality of action and reaction.

This is intimately bound up with the preceding, and it seems indeed that the fall of the one would involve that of the other. Thus we should not be astonished to find here the same difficulties.

Electrical phenomena, we think, are due to the displacements of little charged particles, called electrons, immersed in the medium that we call ether. The movements of these electrons produce perturbations in the neighboring ether; these perturbations propagate themselves in every direction with the velocity of light, and in turn other electrons, originally at rest, are made to vibrate when the perturbation reaches the parts of the ether which touch them.

The electrons, therefore, act on one another, but this action is not direct, it is accomplished through the ether as intermediary.

Under these conditions can there be compensation between action and reaction, at least for an observer who should take account only of the movements of matter, that is to say, of the electrons, and who should be ignorant of those of the ether that he could not see? Evidently not. Even if the compensation should be exact, it could

not be simultaneous. The perturbation is propagated with a finite velocity; it, therefore, reaches the second electron only when the first has long ago entered upon its rest.

This second electron, therefore, will undergo, after a delay, the action of the first, but certainly it will not react on this, since around this first electron nothing any longer budges.

The analysis of the facts permits us to be still more precise. Imagine, for example, a Hertzian generator, like those employed in wireless telegraphy; it sends out energy in every direction; but we can provide it with a parabolic mirror, as Hertz did with his smallest generators, so as to send all the energy produced in a single direction.

What happens then according to the theory? It is that the apparatus recoils as if it were a gun and as if the energy it has projected were a bullet; and that is contrary to the principle of Newton, since our projectile here has no mass, it is not matter, it is energy.

It is still the same, moreover, with a beacon light provided with a reflector, since light is nothing but a perturbation of the electromagnetic field. This beacon light should recoil as if the light it sends out were a projectile. What is the force that this recoil should produce? It is what one has called the Maxwell-Bartholdi pressure. It is very minute, and it has been difficult to put it into evidence even with the most sensitive radiometers; but it suffices that it exists.

If all the energy issuing from our generator falls on a receiver, this will act as if it had received a mechanical shock, which will represent in a sense the compensation of the recoil of the generator; the reaction will be equal to the action, but it will not be simultaneous; the receiver will move on but not at the moment when the generator recoils. If the energy propagates itself indefinitely without encountering a receiver, the compensation will never be made.

Does one say that the space which separates the generator from the receiver and which the perturbation must pass over in going from the one to the other is not void, that it is full not only of ether, but of air; or even in the interplanetary spaces of some fluid subtle but

still ponderable; that this matter undergoes the shock like the receiver at the moment when the energy reaches it, and recoils in its turn when the perturbation quits it? That would save the principle of Newton, but that is not true.

If energy in its diffusion remained always attached to some material substratum, then matter in motion would carry along light with it, and Fizeau has demonstrated that it does nothing of the sort, at least for air. This is what Michelson and Morley have since confirmed.

One may suppose also that the movements of matter, properly so called, are exactly compensated by those of the ether; but that would lead us to the same reflections as just now. The principle so extended would explain everything, since whatever might be the visible movements, we would always have the power of imagining hypothetical movements which compensated them.

But if it is able to explain everything, this is because it does not permit us to foresee anything; it does not enable us to decide between different possible hypotheses, since it explains everything beforehand. It therefore becomes useless.

And then the suppositions that it would be necessary to make on the movements of the ether are not very satisfactory.

If the electric charges double, it would be natural to imagine that the velocities of the divers atoms of ether double also, and for the compensation, it would be necessary that the mean velocity of the ether quadruple.

This is why I have long thought that these consequences of theory, contrary to the principle of Newton, would end some day by being abandoned, and yet the recent experiments on the movements of the electrons issuing from radium seem rather to confirm them.

I arrive at the principle of Lavoisier on the conservation of masses: certes, this is one not to be touched without unsettling all mechanics.

And now certain persons think that it seems true to us only because one considers in mechanics merely moderate velocities, but that it would cease to be true for bodies animated by velocities com-

parable to that of light. Now these velocities, it is believed at present, they have been realised; the cathode rays or those of radium may be formed of very minute particles or of electrons which are displaced with velocities smaller no doubt than that of light, but which might be its one-tenth or one-third.

These rays can be deflected, whether by an electric field, or by a magnetic field, and we are able by comparing these deflections, to measure at the same time the velocity of the electrons and their mass (or rather the relation of their mass to their charge). But when it was seen that these velocities approached that of light, it was decided that a correction was necessary.

These molecules, being electrified, could not be displaced without agitating the ether; to put them in motion it is necessary to overcome a double inertia, that of the molecule itself and that of the ether. The total or apparent mass that one measures is composed, therefore, of two parts: the real or mechanical mass of the molecule and the electro-dynamic mass representing the inertia of the ether.

The calculations of Abraham and the experiments of Kaufmann have then shown that the mechanical mass, properly so called, is null, and that the mass of the electrons, or, at least, of the negative electrons, is of exclusively electro-dynamic origin. This forces us to change the definition of mass; we cannot any longer distinguish mechanical mass and electro-dynamic mass, since then the first would vanish; there is no mass other than electro-dynamic inertia. But, in this case the mass can no longer be constant, it augments with the velocity, and it even depends on the direction, and a body animated by a notable velocity will not oppose the same inertia to the forces which tend to deflect it from its route, as to those which tend to accelerate or to retard its progress.

There is still a resource; the ultimate elements of bodies are electrons, some charged negatively, the others charged positively. The negative electrons have no mass, this is understood; but the positive electrons, from the little we know of them, seem much greater. Perhaps, they have, besides their electro-dynamic mass, a true mechanical mass. The veritable mass of a body would, then,

be the sum of the mechanical masses of its positive electrons, the negative electrons not counting; mass so defined could still be constant.

Alas, this resource also evades us. Recall what we have said of the principle of relativity and of the efforts made to save it. And it is not merely a principle which it is a question of saving, such are the indubitable results of the experiments of Michelson.

Lorentz has been obliged to suppose that all the forces, whatever be their origin, were affected with a coefficient in a medium animated by a uniform translation; this is not sufficient, it is still necessary, says he, that *the masses of all the particles be influenced by a translation to the same degree as the electro-magnetic masses of the electrons.*

So the mechanical masses will vary in accordance with the same laws as the electro-dynamic masses; they cannot, therefore, be constant.

Need I point out that the fall of the principle of Lavoisier involves that of the principle of Newton? This latter signifies that the center of gravity of an isolated system moves in a straight line; but if there is no longer a constant mass, there is no longer a center of gravity, we no longer know even what this is. This is why I said above that the experiments on the cathode rays appeared to justify the doubts of Lorentz on the subject of the principle of Newton.

From all these results, if they are confirmed, would arise an entirely new mechanics, which would be, above all, characterised by this fact, that no velocity could surpass that of light, any more than any temperature could fall below the zero absolute, because bodies would oppose an increasing inertia to the causes, which would tend to accelerate their motion; and this inertia would become infinite when one approached the velocity of light.

No more for an observer carried along himself in a translation he did not suspect could any apparent velocity surpass that of light; and this would be then a contradiction, if we recall that this observer would not use the same clocks as a fixed observer, but, indeed, clocks marking "local time."

Here we are then facing a question I content myself with stating. If there is no longer any mass, what becomes of the law of Newton?

Mass has two aspects, it is at the same time a coefficient of inertia and an attracting mass entering as factor into Newtonian attraction. If the coefficient of inertia is not constant, can the attracting mass be? That is the question.

At least, the principle of the conservation of energy yet remains to us, and this seems more solid. Shall I recall to you how it was in its turn thrown into discredit? This event has made more noise than the preceding and it is in all the memoirs.

From the first works of Becquerel, and, above all, when the Curies had discovered radium, one saw that every radio-active body was an inexhaustible source of radiations. Its activity would seem to subsist without alteration throughout the months and the years. This was already a strain on the principles; these radiations were in fact energy, and from the same morsel of radium this issued and forever issued. But these quantities of energy were too slight to be measured; at least one believed so and was not much disquieted.

The scene changed when Curie bethought himself to put radium in a calorimeter; one saw, then, that the quantity of heat incessantly created was very notable.

The explanations proposed were numerous; but in such case we cannot say, "store is no sore."

In so far as no one of them has prevailed over the others, we cannot be sure there is a good one among them.

Sir W. Ramsay has striven to show that radium is in process of transformation, that it contains a store of energy enormous but not inexhaustible.

The transformation of radium then would produce a million times more of heat than all known transformations; radium would wear itself out in 1250 years; you see that we are at least certain to be settled on this point some hundreds of years from now. While waiting our doubts remain.

In the midst of so many ruins what remains standing? The principle of least action is hitherto intact, and Larmor appears to

believe that it will long survive the others; in reality, it is still more vague and more general.

In presence of this general ruin of the principles, what attitude will mathematical physics take?

And first, before too much excitement, it is proper to ask if all that is really true. All these derogations to the principles are encountered only among infinitesimals; the microscope is necessary to see the Brownian movement; electrons are very light; radium is very rare, and one never has more than some milligrams of it at a time.

And, then, it may be asked if, beside the infinitesimal seen, there be not another infinitesimal unseen counterpoise to the first.

So, there is an interlocutory question, and, as it seems, only experiment can solve it. We have, therefore, only to hand over the matter to the experimenters, and while waiting for them to finally decide the debate, not to preoccupy ourselves with these disquieting problems, and to tranquilly continue our work, as if the principles were still uncontested. Certes, we have much to do without leaving the domain where they may be applied in all security; we have enough to employ our activity during this period of doubts.

And as to these doubts, is it indeed true that we can do nothing to disembarrass science of them? It may be said, it is not alone experimental physics that has given birth to them; mathematical physics has well contributed. It is the experimenters who have seen radium throw out energy, but it is the theorists who have put in evidence all the difficulties raised by the propagation of light across a medium in motion; but for these it is probable we should not have become conscious of them. Well, then, if they have done their best to put us into this embarrassment, it is proper also that they help us to get out of it.

They must subject to critical examination all these new views I have just outlined before you, and abandon the principles only after having made a loyal effort to save them.

What can they do in this sense? That is what I will try to explain.

Among the most interesting problems of mathematical physics, it is proper to give a special place to those relating to the kinetic

theory of gases. Much has already been done in this direction, but much still remains to be done. This theory is an eternal paradox. We have reversibility in the premises and irreversibility in the conclusions; and between the two an abyss. Statistic considerations, the law of great numbers, do they suffice to fill it? Many points still remain obscure to which it is necessary to return, and doubtless many times. In clearing them up, we will undersand better the sense of the principle of Carnot and its place in the ensemble of dynamics, and we will be better armed to properly interpret the curious experiment of Gouy, of which I spoke above.

Should we not also endeavor to obtain a more satisfactory theory of the electro-dynamics of bodies in motion? It is there especially, as I have sufficiently shown above, that difficulties acumulate. Evidently we must heap up hypotheses, we cannot satisfy all the principles at once; heretofore, one has succeeded in safeguarding some only on condition of sacrificing the others; but all hope of obtaining better results is not yet lost. Let us take, therefore, the theory of Lorentz, turn it in all senses, modify it little by little, and perhaps everything will arrange itself.

Thus in place of supposing that bodies in motion undergo a contraction in the sense of the motion, and that this contraction is the same whatever be the nature of these bodies and the forces to which they are otherwise submitted, could we not make an hypothesis more simple and more natural?

We might imagine, for example, that it is the ether which is modified when it is in relative motion in reference to the material medium which it penetrates, that when it is thus modified, it no longer transmits perturbations with the same velocity in every direction. It might transmit more rapidly those which are propagated parallel to the medium, whether in the same sense or in the opposite sense, and less rapidly those which are propagated perpendicularly. The wave surfaces would no longer be spheres, but ellipsoids, and we could dispense with that extraordinary contraction of all bodies.

I cite that only as an example, since the modifications, one might essay, would be evidently susceptible of infinite variation.

It is possible also that astronomy may some day furnish us data

on this point; she it was in the main who raised the question in making us acquainted with the phenomenon of the aberration of light. If we make crudely the theory of aberration, we reach a very curious result. The apparent positions of the stars differ from their real positions because of the motion of the earth, and as this motion is variable, these apparent positions vary. The real position we cannot know, but we can observe the variations of the apparent position. The observations of the aberration show us, therefore, not the movement of the earth, but the variations of this movement; they cannot, therefore, give us information about the absolute motion of the earth. At least this is true in first approximation, but it would be no longer the same if we could appreciate the thousandths of a second. Then it would be seen that the amplitude of the oscillation depends not alone on the variation of the motion, variation which is well known, since it is the motion of our globe on its elliptic orbit, but on the mean value of this motion; so that the constant of aberration would not be altogether the same for all the stars, and the differences would tell us the absolute motion of the earth in space.

This, then, would be, under another form, the ruin of the principle of relativity. We are far, it is true, from appreciating the thousandths of a second, but after all, say some, the total absolute velocity of the earth may be much greater than its relative velocity with respect to the sun. If, for example, it were 300 kilometers per second in place of 30, this would suffice to make the phenomena observable.

I believe that in reasoning thus one admits a too simple theory of aberration. Michelson has shown us, I have told you, that the physical procedures are powerless to put in evidence absolute motion; I am persuaded that the same will be true of the astronomic procedures, however far one pushes precision.

However that may be, the data astronomy will furnish us in this regard will some day be precious to the physicist. While waiting, I believe, the theorists, recalling the experience of Michelson, may anticipate a negative result, and that they would accomplish a

useful work in constructing a theory of aberration which would explain this in advance.

But let us come back to the earth. There also we may aid the experimenters. We can, for example, prepare the ground by studying profoundly the dynamics of electrons; not be it understood in starting from a single hypothesis, but in multiplying hypotheses as much as possible. It will be then for the physicists to utilise our work in seeking the crucial experiment to decide between these different hypotheses.

This dynamics of electrons can be approached from many sides, but among the ways leading thither is one which has been somewhat neglected, and yet this is one of those which promise us most of surprises. It is the movements of the electrons which produce the line of the emission spectra; this is proved by the phenomenon of Zeemann; in an incandescent body, what vibrates is sensitive to the magnet, therefore electrified. This is a very important first point, but no one has gone farther; why are the lines of the spectrum distributed in accordance with a regular law?

These laws have been studied by the experimenters in their least details; they are very precise and relatively simple. The first study of these distributions recalled the harmonics encountered in acoustics; but the difference is great. Not only the numbers of vibrations are not the successive multiples of one same number, but even we do not find anything analogous to the roots of those transcendental equations to which so many problems of mathematical physics conduct us: that of the vibrations of an elastic body of any form, that of the Hertzian oscillations in a generator of any form, the problem of Fourier for the cooling of a solid body.

The laws are simpler, but they are of wholly other nature, and to cite only one of these differences, for the harmonics of high order the number of vibrations tends toward a finite limit, instead of increasing indefinitely.

That has not yet been accounted for, and I believe that there we have one of the most important secrets of nature. Lindemann has made a praiseworthy attempt, but, to my mind, without success; this attempt should be renewed. Thus we will penetrate, so to say, into

the inmost recess of matter. And from the particular point of view which we to-day occupy, when we know why the vibrations of incandescent bodies differ from ordinary elastic vibrations, why the electrons do not behave themselves like the matter which is familiar to us, we will better comprehend the dynamics of electrons and it will be perhaps more easy for us to reconcile it with the principles.

Suppose, now, that all these efforts fail, and after all I do not believe they will, what must be done? Will it be necessary to seek to mend the brdken principles in giving what we French call a *coup de pouce?* That is evidently always possible, and I retract nothing I have formerly said.

Have you not written, you might say if you wished to seek a quarrel with me, have you not written that the principles, though of experimental origin, are now unassailable by experiment because they have become conventions? And now you have just told us the most recent conquests of experiment put these principles in danger. Well, formerly I was right and to-day I am not wrong.

Formerly I was right, and what is now happening is a new proof of it. Take for example the calorimeter experiment of Curie on radium. Is it possible to reconcile that with the principle of the conservation of energy?

It has been attempted in many ways; but there is among them one I should like you to notice.

It has been conjectured that radium was only an intermediary, that it only stored radiations of unknown nature which flashed through space in every direction, traversing all bodies, save radium, without being altered by this passage and without exercising any action upon them. Radium alone took from them a little of their energy and afterward gave it out to us in divers forms.

What an advantageous explanation, and how convenient! First, it is unverifiable and thus irrefutable. Then again it will serve to account for any derogation whatever to the principle of Mayer; it responds in advance not only to the objection of Curie, but to all the objections that future experimenters might accumulate. This energy new and unknown would serve for everything. This is just

what I have said, and therewith we are shown that our principle is unassailable by experiment.

And after all, what have we gained by this *coup de pouce?*

The principle is intact, but thenceforth of what use is it?

It permitted us to foresee that in such or such circumstance we could count on such a total quantity of energy; it limited us; but now that one puts at our disposition this indefinite provision of new energy, we are limited by nothing; and, as I have written also, if a principle ceases to be fecund, experiment without contradicting it directy, will however have condemned it.

This, therefore, is not what would have to be done, it would be necessary to rebuild anew.

If we were cornered down to this necessity, we should moreover console ourselves. It would not be necessary thence to conclude that science can weave only a Penelope's web, that it can build only ephemeral constructions, which it is soon forced to demolish from top to bottom with its own hands.

As I have said, we have already passed through a like crisis. I have shown you that in the second mathematical physics, that of the principles, we find traces of the first, that of the central forces; it will be just the same if we must learn a third.

Of such an animal as exuviates, as breaks its too narrow carapace and makes itself a fresh one, under the new envelop we easily recognise the essential traits of the organism which have subsisted.

We cannot foresee in what way we are about to expand; perhaps it is the kinetic theory of gases which is about to undergo development and serve as model to the others. Then, the facts which first appeared to us as simple, thereafter will be merely results of a very great number of elementary facts which only the laws of chance make co-operate for a common end. Physical law will then take an entirely new aspect; it will no longer be solely a differential equation, it will take the character of a statistical law.

Perhaps likewise, we should construct a whole new mechanics, that we only succeed in catching a glimpse of, where inertia increasing with the velocity, the velocity of light would become an impassable limit.

The ordinary mechanics, more simple, would remain a first approximation, since it would be true for velocities not too great, so that one would still find the old dynamics under the new.

We should not have to regret having believed in the principles, and even, since velocities too great for the old formulas would always be only exceptional, the surest way in practice would be still to act as if we continued to believe in them. They are so useful, it would be necessary to keep a place for them. To determine to exclude them altogether, would be to deprive oneself of a precious weapon. I hasten to say in conclusion we are not yet there, and as yet nothing proves that the principles will not come forth from the combat victorious and intact.

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MEANING OF THE EPITHET NAZOREAN (NAZARENE).[1]

I.

(Read before the Section of New Testament, Congress of Arts and Science, St. Louis, September 23, 1904.)

"BEING warned (of God) in a dream, he withdrew into the parts of Galilee, and came and dwelt in a city called Nazareth: that it might be fulfilled which was spoken through the prophets, that he should be called Nazorean." (Matt. ii. 22b, 23.)

The unhistoricity of the Matthean no less than of the Lucan prehistory is conceded in critical circles. Thus, even Zahn says: (*Das Evang. des Matth.*, p. 109): "Not the silence of Josephus.... but the narrative of Luke (ii. 21, 22, 39), which appears to exclude the total content of Matt. ii, can arouse serious scruples," and these he makes no attempt to lay. All the more firmly is the birth, or at least the early residence, in Nazareth everywhere upheld, if not assumed, as beyond question. So too the correctness of Matthew's etymology, "Nazorean" from Nazareth. But here difficulties begin to gather.

1. The reason assigned seems unreal. Nowhere is it spoken through the prophets, "He shall be called Nazorean," nor anything nearly equivalent. Zahn exposes the emptiness of all other explanations but Hofmann's, which he adopts in piety only, though itself

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[1] In the transcription of Greek, Hebrew, and other alphabets:
ch stands for the guttural *h*, frequently transcribed as an underdotted *ḥ* or *kh*, to be pronounced like the German *ch* in *acht*.
sh is nearest to the English sound *sh*.
ʒ denotes the German *z*, a sharp sibilant pronounced *ts*, sometimes transcribed by underdotted *s*. EDITOR.

the emptiest of all, namely: that it was spoken by the prophets that he should be misunderstood and lowly, which Matthew would express by the term *Nazorean.* But the bald fact is that He was called (*the*) *Nazorean* without any even remote allusion to lowliness or misunderstanding, and this single fact it is that Matthew would explain by early residence in Nazareth. The inevitable suggestion then is this: The Jesus was called (*Ho*) *Nazōraios.* Since this fact was most important, the Evangelist thought it must be spoken by the prophets, who had foretold all things of the Messiah. Moreover, it had to be explained some way, and the least objectionable way was to derive it from a place of early residence. Accordingly, this datum of childhood in Nazareth would take its place side by side with other data of the prehistory, as the visit of magi, the massacre of infants, the flight into Egypt. All are in fact of a piece; why should one be taken, and the other left?

2. The "city called Nazareth" seems to be a geographical imagination; it is unmentioned in the Old Testament, in the Talmud,[2] in Josephus, in Apocrypha. The first notice of it is in Eusebius, quoting professedly from Julius Africanus; the next, in Jerome, is worse than none at all; next Epiphanius speaks of it along with several Galilean places as inhabited down to Constantine exclusively by Jews (no Pagans, no Samaritans, no Christians). These mentions signify nothing as to the pre-Christian reality of Nazareth. For they are all perfunctory. Themselves believing, of course, in the actuality of the city, the writers could hardly fail to mention it in such connections, whether or not it was bodily there. Again, even if there was a so-named village there in the third or fourth century, nothing would follow as to it or its name before the first. After the notion of the early life of Jesus in "a city called Nazareth" had been firmly established, we may be sure that the city itself would not long be wanting. Two or three centuries would be quite long enough for its genesis or new-naming. The silence of contemporary and earlier history is of course not conclusive, but it is the strongest negative evidence possible. We cannot expect the

[2] Which names 63 cities of Galilee.

unprophetic historian to say: "In this region 'a city called Nazareth' does not exist."

3. Nazareth cuts no figure at all in the tradition concerning Jesus. Not Nazareth but Chephar Nachum is called "his city." So all the moderns, with Chrysostom and common sense,—against Jerome. There he was "at home," according to Mark ii. 1. There was the scene of his first preaching, and triumphs, and friendships. This could hardly have been, if Nazareth had been his home. True, both Matthew and Mark tell of his going into his *patris*, but they do *not* (against Graetz, Frankel's *Monatsschrift*, 29, 482) say what was the *patris, a strange omission! Why did they not say Nazareth*, if they meant it? This pericope (Matt. xiii 53-58, Mark vi. 1-6) it seems, is meant merely to visualise the proverb, "A prophet is not without honor save in his *patris*" (Judea? Judaism?): it testifies not for, but against, the geographic entity of Nazareth. Luke, indeed, is explicit. He mentions Nazareth and tells how they led him to the "brow of the hill," in order to throw him down (iv. 16-30),—all this at the beginning of his ministry, against the earlier report in Matthew and Mark! But this Lucan form is plainly a much later elaboration, and testifies to nothing but the hand of the reviser (See Keim, *Jesus von Nazara*, II, p. 19 f., 425). So, too, the phrase, "he from Nazareth," is simply a later variation of "the Nazorean," just as our English versions say "this Jesus of Nazareth," where the Greek says "this Jesus the Nazorean" (Acts vi. 14).

Similarly, of Nathanael's question, "Can ought good come out of Nazareth?" (J. i. 47). The deep symbolism of this whole section we make no attempt here to sound. Enough that it is clearly symbolism, and not history, and bears no witness worth mention to a topographical Nazareth. (Nathanael, otherwise unknown, seems to be the notable pre-Christian Gnostic, Dositheus.)

4. But if the testimony of the New Testament is thus hesitating and indecisive concerning "the city," and appears only in the *later* strata of tradition, being entirely absent from the *earlier*, an exceedingly strong negative indication, the same can not be said of the epithet (*the*) *Nazorean*. This occurs repeatedly in apparently the oldest layers of the Gospel story, without any suggestion of tend-

ency, especially in Acts, and more than all, it is used in the plural as the name of the new religionists (xxiv. 5): Tertullus describes Paul as a ringleader of the heresy of "the Nazoreans." It seems impossible that this name should have become their vulgar designation, unless it had been a very early and important designation. Moreover, we know that it was used in the Talmud and Koran, and is still used by the Oriental Christians. In Mark the epithet is so distinctive that it is put into the mouth of the maid as *the* name of the arrested one: "Thou also wast with *the Nazarene* (the Jesus)" (xiv. 67). All this indicates that this epithet was from the start highly distinctive and familiar, a name in itself, which would be passing strange, if it was indeed derived from a most obscure village otherwise unknown. This comes out clearly in the Hebrew-speaking voice to Paul: "I am Jesus the Nazorean" (A. xxii. 8). The epithet is quite unnecessary for identification, in two of the three reports it is omitted: its presence in this one shows that it was originally an integral part of the whole name, and as such it must have had important meaning and have pointed to something else than a wholly indifferent early residence in Nazareth.

5. The name "the Nazoreans" occurs in the Talmud unmistakably denoting the Christians (b. Taan. 27b). " 'Why did they not fast on the day after the Sabbath?' Rabbi Jochanan replied: '*Because of the Nazoreans*'" (*Mipnê ha-Nôẓrîm*). Now this word Nôẓrîm was perfectly familiar to the Hebrew and had been for hundreds of years. It occurs repeatedly in the Old Testament, as in 2 K. xvii. 9, xviii. 8, Jer. xxxi. 6, and always in the one sense of *guards, watchers.* The root *naẓar* is one of the best known in the Semitic languages, and its meaning is perfectly definite and well ascertained: to watch, observe, keep, guard, defend, preserve. In this sense it is constant in the Old Testament, occurring 63 times, the desibilated form *natar* 10 times. But it is much older than the Hebrew Scriptures. It is frequent in the Cuneiform inscriptions. Thus, V. R., 8: 65-67, "and Abiyati, son of Ti-i-i-ri, not meditated good, not kept oath (*la na-ẓir ma-mit*) of gods mighty"; and V. R. 1. 115, "Guards (*Maẓarati*) upon those of days before"; in the Code of CHammurabi (2250 B. C.) it occurs 7 times, as 23, 66 and 24, 6,

"in case watchful was she and...." (*shum-ma na-aẓ-ra-at-ma....*), as in 30, 47, "estate they shall preserve" (*bîtam i-na-ẓa-ru*). The popularity and familiarity of the word are attested by the regular use of its imperative (*uẓur* for *nuẓur*) in forming proper names, as *Nabu-kudurri-uẓur* (Nabu, landmark mine defend), Bel-shar-*uẓur* (God save the King), etc.—also in such phrases as *bît ni-ẓir-ti* = house of treasure. The use of the segholate *neẓer* in the sense of *sprout, shoot, branch*, is only occasional, thrice in Isaiah, once in Daniel, and may here be left out of account, since it could not yield the plural *nôẓrîm* and has naught to do with the matter in hand. Now, since *ha-Nôẓrîm* was thus the perfectly familiar term for *the Guards, the Preservers*, it follows that when the term was used, or its Greek equivalent, *Hoi Nazōraioi*, the suggestion of the well-known meaning was inevitable. Even if the name had actually been derived from the hamlet of Nazareth, no one would have thought so, every one would have turned to the household meaning, instantly and irresistibly. If a class of persons were called the Preservers, every one would understand it so, as *they that preserve;* no one would dream of deriving their name from the unknown village of *Preserveth.* We insist upon this, because it seems decisive.

6. But what of the singular, *Ho Nazoraios* or *Ha-Nôẓrî*? This is the single point, not so much of difficulty as of *uncertainty*, for several possibilities lie open. The Old Testament singular of *Nôẓrîm* is *Nôẓēr*, the participle of *naẓar*, frequently occurring. The termination ◌ִי is generally used to designate local derivations, but not uniformly; it is added to other nouns than those of place, to adjectives also, and even to prepositions, sometimes apparently for emphasis, with little change in meaning, as is noted by Green, Stade, and other Hebraists; similarly in Syriac Nöldeke speaks of its frequent parasitic presence (*Kurzgefasste Syrische Grammatik*). Among many examples the nearest parallel seems to be נכר. The root combines queerly enough the opposite ideas of *knowing* and *not knowing*. From the latter comes נֵכָר = *stranger* used thirty-five times in the Old Testament; also נֵכָר = *strange*, used once; also נׇכְרִי = *stranger*, once; but נׇכְרִי = *stranger*, forty-five times.

There is no reason, then, why *nôẓrî may* not be formed from *nôẓēr* without real change of meaning.

Secondly, *nôẓrî* may very well be a Rabbinic disguise for *nôẓēr*. Possibly the Talmudists wished to deform the name slightly, as often the names they disliked. Thus, the appellative of the rationalistic Bible critic, CHivi, they changed from *al-Balkhi* to *al-Kalbi* (JBL XXIII, 6), and Evangelion they turned into *Avon-* or *Aven-giljon* (b. Shabb. 116a). Possibly they formed *Ha-Nôẓrî* on the basis of a Christian Evangelic tradition that Jesus was of Naẓara. The form *Nôẓrî* cannot indeed come from Naẓara, but requires a Noẓera as the town-name, as Herford perceives. He thinks *noẓera* may have been the local Galilean pronunciation. More likely that the Talmudists slightly bent the name *nôẓēr*, as if it were *nôẓrî* from *noẓera*. Possibly the ' was added, as in a good many cases, to personalise more sharply the participle, somewhat as we say the *guard* and also the *guardian*.

Still another possibility, however, and an extremely attractive one, is this: the ' may be a fragment representing the divine name YHVH.[3] If so, then the full primitive appellative was *Nazōraios* for NZRYH, *Watch of Jehovah*, or *Jehovah the Keeper*. This suggestion is strongly recommended by this fact: In the "name of the Restitution" of Marcus we find the form Ἰησοῦ Ναζαρία. Marcus is supposed to have been a second-century heretic, but he was certainly a *most* important one, to judge from Irenæus and Hippolytus, and his "name of the Restitution": "Anointed and redeemed am I from Soul and from all judgment by Yah (dyh); redeem (my) soul, O Jesu Nazaria," seems to be extremely old; it is given in Syriac but not understood by Irenæus (I. xiv. 2). Such a formula would very naturally and probably harken back to the highest antiquity. We note, further, that the redemption is in the name of Yah, and Jesus is invoked as Nazar-Ya'. This latter is the only Syriac form, as appears from the Peshito and from Payne Smith's *Thesaurus Syriacus*. (The latter of course assumes the derivation of *Naẓar-ya'* from Nazareth, but makes no attempt to justify the assumption.)

[3] As in נַחְבִּי (*Naᶜhbi*) = "Comforter is Yah," Num. xiii. 14.

All of which points to this latter as the *very oldest* form of the appellative and as involving the divine name Yah or Yahveh, precisely as Zacharyah and the multitude of names ending in *iah*.

It must be remembered that the Syriac termination *Ya'* is exactly the same in *Nazar-ya'* as, e. g., in *Z'char-ya' bar B'rach-ya'* (Mt. XXIII. 35), and regularly represents the יָהּ (*Yah*) of the Hebrew. It would be very strange if this termination had an altogether unique gentilicial reference in *Nazar-ya'*. Moreover, it is at once perceived that in the formula of Marcus any local derivative is utterly out of place; the epithet, *Nazar-ya'*, must be charged with weighty meaning. Similarly, in the trilingual inscription on the Cross (J. xix. 19), it seems impossible that the epithet Nazorean (*Naẓar-ya'*) should mean "of Nazareth," a village in Galilee over which Pilate had no jurisdiction.[4] It must tell not of the home but of the nature, the character, the personality.

Be this as it may, it seems reasonably certain that Nazōraios had originally nothing to do with the imaginary village Nazareth; that it was a *descriptive appellative,* like others so commonly appended to divine names, both classic and Semitic (cp. Zeus Xenios, Hermes Psychopompos, Dionysos Hypokolpios, Apollo Pythios, and the like); that it designated some *divine* power in the aspect, character, or person of Guardian, Preserver, being nearly identical in meaning with ὁ Ἰησοῦς, the Saviour, and the pure Greek term preferred by the Gnostics but disowned by the Old Catholics, ὁ Σωτήρ. It must be remarked that this salvation was especially from demons and from sin, the work of demons. Hence the title, ὁ Ἰησοῦς, was the name that was specially and exclusively invoked in casting out demons and in primitive baptism, which was primarily the washing away of spiritual uncleanness due to demons.

It should be added that both Neubauer (*La Géographie du Talmud,* 190) and Grätz (*l. c.*) think to find Nazareth in the Talmud. and both with the same unreason. In Josh. xix. 15 are enumerated as belonging to Zebulun the cities: "And Kattath, and Nahallal, and Shimron, and Idalah, and Beth-lehem: twelve cities and their vil-

[4] As Dr. Paul Carus acutely suggests.

lages." The Talmud (Megilla 70a) repeats this list in slightly varied form, preserving the name Beth-lehem but adding Zeryēh (בית לחם צרייה). Now Neubauer and Grätz insert the letter נ before צ and vocalise the result into Nozeryyah, which is not *wholly* unlike Nazareth! Hence Neubauer thinks we should translate the Talmudic passage thus: *Bethlehem near Nazareth,* according to which the utterly obscure village of Nazareth was so much more important than the ancient historic city of Bethlehem that the latter had to be defined by reference to the former! Grätz perceives the improbability and hence translates his conjectural text thus: *Bethlehem of Nazareth,* understanding Nazareth as a post-exilic name for Galilee, in direct contradiction of the Evangelic phrase "Nazareth *of* Galilee," and this conjecture is adopted by Cheyne, to whom belongs the credit of explicitly stamping the "city called Nazareth" as a fiction (*Enc. Bibl.*, Art. "Nazareth"). But if Nazareth was such a familiar name of Galilee as to make *Nazorean* preferred to *Galilean* as a gentilicium, *assuredly we should have heard of it.* The fact is that Neubauer and Grätz have found Nazareth in the Talmud only because they sought it there. He who seeks shall find. But the word is *not* there, and neither scholar offers any reason for inserting the נ. Closer inspection shows, first, that the Masoretic text of Joshua is maimed, since only five cities are named, not twelve, and the Septuagint omits the final clause; secondly, that the Zeryēh is most likely derived from the oft-recurring, very similarly written וְחַצְרֵיהֶן (*vchaẓrêhen*) = " and their villages," only four words below. Certainly the nearest-lying supposition is that the Talmudic text or its source, like the defective Masoretic text, meant to say something about the cities *and their villages.* Hence the ingenious conjectures of Neubauer, Grätz, and Cheyne, not to mention Halévy and Wellhausen, appear both needless and unwarranted. Neither do they nearly touch the heart of the matter, which is that by every token *Naẓar-ya'* was primarily like ὁ Ἰησοῦς and ὁ Σωτήρ, an *appellative of a god.*[5]

[5] That נֵצֶר was at some time felt to involve a Messianic reference, seems hinted in the large נ with which it is written in Ex. xxxiv. 7, as Zuschlag has observed.

The question remains, whence the Marcan form Nazarene (Ναζαρηνός)? It is commonly derived from Nazara, as Magdalene from Magdala; but, in spite of Keim and his learned note, this form Nazara is too feebly attested. In reality the form Ναζαρηνός explains itself when we recall that in Aramæan, according to Dalman (*Aramäisch-neuhebräisches Wörterbuch,* page 257), the word *Natrôna'* (נטרונא) means "defender" (*Beschützer*), which at once yields *Nazarene,* the Aramaic *ṭ* (ט) corresponding to the Hebrew *ṣ* (צ). *Naẓar-ya'* remains in all likelihood the most primitive form, since the Marcosian "name of restitution" far antedates any manuscript of our second Gospel.

Since the foregoing was written, we have lit upon a most decisive confirmation. In the Paris Papyrus, at line 3119-20, we read: .... ὁρκίζω σε κατὰ τοῦ θεοῦ τῶν Ἑβραίων Ἰησοῦ ιαβαιαη .... and other meaningless alphabetic combinations apparently to be sung (these latter seem to be documentary specimens of the "speech in tongues" of Acts and first Corinthians). "I adjure thee by the God of the Hebrews, Jesus." This "Logos" is declared to be "Hebraic," it is full of the Old Testament, it is assigned by the Papyrus editor, Dieterich, positively to the Essenes or Therapeutæ, who were certainly pre-Christian, and it itself is surely *not* post-Christian. There is in the whole "Logos" not a trace of Christian influence. That "Jesus" is herein called "the God of the Hebrews," of itself implies that the document is at least as old as the beginning of our era. At this date, therefore, we find that "Jesus" was the name used in conjurations for "the God of the Hebrews"—a fact whose importance it seems impossible to overrate.[6]

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[6] It must not be supposed that the results attained exclude the possibility that there arose in some minds at some time a confusion of the terms and the notions נצר and נזיר (*nāzir,* Nazirite), especially as the LXX rendered ר by ζ and ץ generally by σ, but not always, sometimes by ζ, thus עזץ = *obζ* (Gen. x. 23). It is *possible* that the writer of Mt. ii. 23 remembered Ju. xiii. 5 (he shall be a Nazir of God etc.), and so was emboldened to use the phrase, "through the prophets." But of these and other minor points lack of time forbids discussion.

II.

It did not fall within the scope of the foregoing investigation to discuss the heresiographic testimony, in particular of Epiphanius, touching the primitive sect of the "Nazaraioi." That investigation was in its conception almost purely philologic, and its design was to establish whatever conclusions seemed recommended, as at least highly probable, on the sole basis of certain linguistic facts. In accordance with the critical method already exemplified by the writer in a series of New Testament studies, it was intended to elicit the full evidence of these facts uncomplicated with any suggestions or modifications that might proceed from the consideration of any other foreign body of facts however closely related to the matter in hand. But this accomplished, it now becomes our duty to fix our attention on this other body of testimony and to interpret it naturally and so far as possible in utter forgetfulness of the results already attained. If such interpretation confirms these results, well and good,—by the mouths of two independent witnesses our conclusions have been established; but if there be any serious discrepance between the two sets of results, then there has been some error in our work, which must be detected and corrected. We may state in advance that this testimony, found in the *Panarion* of Epiphanius,[7] proves to be very elaborate and explicit, and while not free from obscurity and even contradiction (*"den confusen Angaben des Epiphanius,"* Harnack, *D G*3, I. 288), it is none the less unambiguous and conclusive as to the main issue, it is in fact the end of controversy.

After describing briefly the heresy of the Daily Bathers (Hemerobaptists), Epiphanius sets himself "to expound that of the Nazaraioi, who are Jews by race, taking their start from Galaaditis and Basinitis and the (regions) beyond the Jordan, as the report that has reached us comprehends, which, being of Israel itself, Judaises in all things, thinking scarcely aught beyond the aforementioned (sects). For circumcision exactly so it possessed, Sab-

[7] Hæres. XVIII., Κατα Ναζαραιων and XXIX., Καατ Ναζωραιων.

bath the same it kept, feasts the same it persevered in, not however (the notion of) destiny it introduced, nor astronomy. And (the) Fathers it received, those in the Pentateuch from Adam to Moses, those that were conspicuous by virtue of godliness,—I mean Adam, and Seth, and Enoch, and Methuselah, and Noah, and Abraham, and Isaac, and Jacob, Levi too, and Aaron, and Jesus the son of Nun. But it did not receive the Pentateuch itself, however it confesses Moses, and believed what he received (as) legislation; not this, it says, but another. Whence all the (customs) of Jews they keep, being Jews (themselves), but sacrifice they did not sacrifice, nor partake of animates; but it was unlawful with them to partake of their flesh or to sacrifice them. For they assert that these books were fabricated and that none of them proceeded from the Fathers. This was the distinction of the Nazaraioi from the others."

The remaining (second and third) sections are devoted after the manner of Epiphanius to a refutation of these heretics, which however does not concern us.

We observe that these Nazaraioi are Jews, that they are localised east of the Jordan, are vegetarians, are heterodox in rejecting the inspiration and authority of the Hebrew Scriptures. There is no suggestion of Christianity about them. Neither are they Nazirites (Naziraioi), whom Epiphanius mentions hereafter; in no particular do they resemble these latter, they are rather antipodal, their practice being directly counter to that prescribed for the Nazir (Num. vi.). Petavius then errs as widely as possible in writing "Nazaræi veteres נזירים proprie vocati, quasi *sancti*, et *separati*;" but these words are extremely interesting as the counsel of desperation. It appears then that both the name Nazaraioi and they that bore it were before Christianity and independent of Christianity. Hence the name can not be derived from any early residence of Jesus in Nazareth, nor indeed with the least probability from Nazareth at all. It is next to impossible that a sect located beyond the Jordan should take its name from an insignificant village on this side of the Jordan.

What evasions are possible? It can not be that Epiphanius is speaking of a sect that arose after Christ, else he would have

dropped some hint to that effect; moreover, and this is decisive, he afterwards declares explicitly (XXIX. 6) that the Nasaraioi were "before Christ."

The name here used is Nazaraioi, whereas the form commonly used, as in the New Testament and elsewhere by Epiphanius himself, is Nazōraioi. But no one is likely to claim that this is more than a difference in spelling of the same word. The irritating confusion of the vowels *a* and *o* is one of the first things to repel the student of Syriac. Both forms present themselves in New Testament manuscripts, as at Mk. x. 47, L. xviii. 37, xxiv. 19, so that no one can say with certainty which of the vowels ⲁ, ⲟ, ⲱ is to be preferred. Perhaps all have nearly equal justification.

Can it be that Epiphanius did not know what he was talking about? Impossible. His antiquarian learning and industry are universally admitted. Petavius indeed says dubiously, "I do not know whether any other besides Epiphanius has mentioned such a heresy of Jewish name." To be sure! There was every reason why Christian writers at least should *not* mention them. The wonder is that Epiphanius has constated their existence. But there is no reason whatever for doubting his testimony that they were, whether or not his account of them be quite accurate. It is only their name and the fact of their being that bear on our argument.

However, this is by no means the full deposition of the Bishop of Constantia. Among Christian heresies, having treated of the Cerinthians he proceeds (XXIX.) Κατα Ναζωραιων:

"Nazōraioi follow these next in order, being along with them, whether before them or with them or after them, nevertheless contemporary; for not more accurately can I declare who succeeded whom. For just as I said, they were contemporary with one another, and similar the opinions they cherished. For these applied to themselves the name not indeed of Christ, nor even the name of the Jesus, but of Nazōraioi. And all Christians then were likewise called Nazōraioi. But it happened for a little time they were called Jessaioi, before the disciples began to be called Christians at Antioch. And they were called Jessaioi on account of Jesse, I think." There follows a very prolix dissertation on the royalty and the priest-

hood, in elaboration of this idea, none of which has any bearing on our inquiry. Epiphanius concludes it finally and proceeds:

"And there is much to say about this. But, nevertheless, since I have come to that point, to say for what cause they were called Jessaioi, before being called Christians, they that had believed on Christ, (it was) for this reason, we said, that Jesse was the father of David. And either from Jesse or from the name of Jesus our Lord they were called Jessaioi, on account of their starting from Jesus, being his disciples, or on account of the etymology of the name of the Lord. For Jesus in the Hebrew dialect is called (signifies) *curator* (*θεραπευτής*), that is, Physician and Saviour. Anyway, with this name, before their being called Christians, they were dubbed as a surname. But from Antioch, as we have noted above, as is the basis of the truth, began the disciples and all the Church of God to be called Christian."—Epiphanius then proceeds to identify these extremely interesting Jessaioi with the subjects of the well-known writings of Philo, supposed to deal with the Essaioi or Essēnoi, whether correctly or incorrectly we cannot here discuss. He then continues:

"As accordingly they were then called Jessaioi, for a little time after the ascension of the Saviour, and Marcus' having preached in the land of the Ægyptians, about those times some went out again, followers indeed of the apostles, I mean those there appear to me evidently Nazōraioi, being Jews by race and adhering to the Law, and practicing circumcision; but as persons beholding a fire from a lookout, and not thinking for what cause they had kindled this fire, or what useful purpose, do it, whether preparing the provisions of their life for eating by means of the fire, or for getting rid of some inflammable sticks or twigs such as are wont to be consumed by fire,—so also they themselves, imitating, lighting up a fire, burned themselves. For having heard only Jesus' name and having beheld the divine signs wrought by the hands of the apostles, they themselves also believe on Jesus. And knowing him as of Nazaret, conceived in womb, and brought up in Joseph's house, and therefore in the Gospel called Jesus the Nazōraios, as also the apostles say, "Jesus the Nazōraios, a man approved both by signs and wonders,"

and so forth, this name they impose upon themselves, to be called Nazōraioi, but not Naziraioi, which is interpreted "sanctified." For this was of old the prerogative (ἀξίωμα) of the first-born, and those consecrated to God, one of whom was Sampson, and others after him and before him many. Yea, John the Baptist also was himself one of these same vanguards of God, and wine and fermented liquor he did not drink. For this was the policy appointed for such men as befitting their dignity (ἀξίωμα).

"But others called themselves Nasaraioi. For the heresy of the Nasaraioi was before Christ and knew not Christ. But all men called the Christians Nazōraioi, as I said before, as say accusers of Paul the Apostle: 'This man we found pestilent and perverting the people, being ringleader too of the heresy of the Nazōraioi.' And the holy Apostle denies not the name, not confessing the heresy of these, but gladly accepting the name imposed upon him, by the malignity of the gainsayers on account of the Christ. For he says on the bema: 'Neither in the temple found they me disputing against any one, nor making any riot of the crowd, nor of what things they accuse me have I done aught. But I confess thee this, that according to the way which these call heresy, do I worship, believing all that is in the Law and the Prophets.' And no wonder that the Apostle confesses himself Nazōraios, (as) all (were) then calling the Christians by this name, on account of Nazaret the city, there being no other use for the name at the time, so as for men to call those that had believed in the Christ, about whom it has been written, 'that he shall be called Nazōraios.' For men even now by the same name call all the heresies Christian, I mean both Manicheans and Marcionists, both Gnostics and others, that are not Christians; and yet each heresy, although called otherwise, receives this (name) rejoicing, because by the name it is adorned. For they think to be magnified by the name of the Christ, not indeed by the faith and the works. So also the holy disciples of the Christ called themselves then disciples of Jesus, as indeed they also were; but hearing themselves (called) of others Nazōraioi, they did not disclaim, seeing the aim of those calling them this, because they called them (so) on account of Christ; since also the Lord Jesus himself was called Nazō-

raios,as the Gospels have it, and the Acts of the Apostles; on account of his having been brought up in the city of Nazaret, which however is now a village, in Joseph's house, having been generated according to flesh in Bethlehem from Mary the ever-virginal, the betrothed to Joseph the immigrant in the same Nazaret, after, having changed from Bethlehem, he had settled down in Galilee.

"But these the afore-mentioned heretics, about whom we are here making our narration, passing by the name of the Jesus, neither called themselves Jessaioi, nor retained the name of the Jews, nor surnamed themselves Christians, but Nazōraioi, plainly from the surname of the place, the Nazaret. But in all regards they are Jews, and nothing other. And these use not only (the) New Covenant but also (the) Old, just as also the Jews. For there have not been renounced among them Law, and Prophets, and Scriptures, these called Biblia (Hagiographa) among Jews, as among the afore-mentioned; nor aught else do these think but according to the preaching of the Law, and as the Jews all things exactly they confess, except indeed the having believed on Christ. For among them also resurrection of (the) dead is confessed, and that the universe has been generated from God. And God they proclaim as One, and his child Jesus Christ. And in Hebrew dialect accurately they are versed. For among them all the Law, and the Prophets, and the Hagiographa (so-)called, I mean the Sticherē, and the Kings and Paralipomena, and Esther, and all the others are read in Hebrew, as of course also among Jews. In this alone they differ from Jews and Christians, not according with Jews on account of (their) believing on Christ, and not agreeing with Christians on account of their being still fettered by Law, both circumcision and Sabbath and the rest. But concerning Christ I cannot say whether they too, weighed down by the wickedness of the aforementioned disciples (περί) of Cerinthus and Merinthus, deem (him) mere man; or, as the truth is, firmly hold him to have been generated through the Holy Spirit from Mary. And this the heresy of the Nazōraioi is in Berœa, about Cœle-Syria, and in Decapolis, about the regions of Pella, and in Basinitis that is called Kokabe but in Hebrew Chochabe. For thence the beginning arose, after the

migration from Jerusalem of all the disciples that settled in Pella, Christ having told them to abandon Jerusalem and to depart, since it was going to suffer a siege. And on such a basis having settled in Peræa, there, as I said, they passed the time. Thence the heresy of the Nazōraioi had its origin."

With the next section, an argument about circumcision, we have no concern. Epiphanius then continues: "Altogether hateful are these to the Jews. For not only do the children of the Jews cherish hatred towards these, but on arising at dawn,[8] and at midday, and at eventide, thrice a day, when they perform devotions in their synagogues, they curse them and anathematise saying that 'Accurse doth God the Nazōraioi.' For against these they lay it up more especially that being themselves of the Jews they preach Jesus to be Christ, which is counter to those that are still Jews, that have not received Christ. And they have the Gospel according to Matthew most complete in Hebrew. For among them undoubtedly this, just as from the beginning it was written in Hebrew letters, is preserved. But I know not whether the genealogies, those from Abraham to Christ, they took away. Well, having detected this (heresy) as a dull and, on account of the poison, pain-producing cell of wasps, and having crushed it down with the words of truth, let us go on to the next, my dearest ones, asking from God His help."

Here follows the chapter Κατα Εβιωναιων.

We have reproduced so much of Epiphanius in a translation so slavishly literal, because his writings are not very accessible, and to show as clearly as possible his style of thought and expression, as well as to avoid taking any liberties of interpretation. The whole passage is one of exceeding importance. With its glaring contradictions, due perhaps in large measure to interpolation, we have nothing to do, except as noted below. The great central fact is this: Epiphanius testifies unequivocally that the Nasaraioi were "before Christ" and "knew not Christ." On this point it is impossible that he should be mistaken. For he was unquestionably learned, and

[8] We read here ἐωθεν for ἐσωθεν.

laborious, and inquisitive, however shortsighted, fanatical, and intolerant. Hilgenfeld bears repeated witness to his "richer knowledge," "exacter knowledge," independent research, and the like. That he should have invented these pre-Christian Nasaraioi is quite incredible. For they were evidently a most painful and venomous thorn in his flesh. Their existence was a vexatious mystery, which he toils desperately and pitiably to explain. How wearisomely he reiterates that the name was taken from Nazaret, as if reiteration might finally make it so! He mentions these sectarians merely because he must, he cudgels his brains cruelly to make out what they can mean, he involves himself in hopeless contradictions in trying to solve the riddle, and at last he cuts the Gordian knot by dating them from the siege of Jerusalem (A. D. 68), though they were pre-Christian, and Paul was one of them nearly twenty years before! It is clear as noon from the painstaking, the repetitions, the discrepancies, and especially from the closing sentence, that the task was not a grateful one to Epiphanius, and that he would gladly have forgone it if he could.

The dumbness of other heresiologists (except Philaster, who also mentions the Jewish sect of the Nazareans) now becomes more expressive than their speech. It was just because they had wit enough to perceive the danger of discussing these Nasaraioi, that they maintained a prudent but ominous silence, broken only by harmless allusions to their heretical doctrines. But the valor of Epiphanius got the better of his discretion. In the providence of God the foolishness of the Bishop has availed far more for the truth than the wisdom of his predecessors and contemporaries, and even of his successors in modern times. These latter give this original and universal designation of the Christians but the scantiest recognition. A careful search through all accessible authorities discovers hardly anything that is pertinent and worth quoting. Petavius contents himself with a few notes and skeptical phrases, none of which throw light on the subject. Hilgenfeld names the *Nazaräer* and *Nasaräer* repeatedly in his standard *Ketzergeschichte,* regarding them apparently as the "remnant of the primitive Jewish-Christian congregation," but the important question he does not mention. In

his *Die Entstehung der altkatholischen Kirche* (Dutch translation [1868], p. 148 ff.) Ritschl discusses "the Nazaräer and the Pharasaic Ebionites," regarding the former as the original apostolic Christians, but neither he nor Tübingen, old or new, approaches the heart of the matter, the pre-Christian existence of the "heresy."

We have no space to treat the vexed question of the Ebionites and the Essenes, but we must press the query as to the Nasaraioi, for there is the pivot of controversy. We note that our author cautiously shuts up and locks the natural door of escape, by distinguishing his sectaries expressly from the Naziraioi, or *sanctified*, with whom Petavius would identify them.[9] We observe further that he says of those who were "before Christ," they "called themselves Nasaraioi." This is important. For such is the exact transliteration of the older form preserved in the Syriac (both Peshito and Sinaitic), Naʒarya. Here then our expectations are met precisely. For the natural and almost, though not quite, uniform transliteration of ʒ is σ and not ζ. Again, the name of the pure Jewish sect is given always as Ναζαραῖοι, never as Ναζωραῖοι. Here then is a notable gradation: Νασαραιοι, Ναζαραιοι, Ναζωραιοι, finally Ναζαρηνοι. Only the first conforms strictly to the Syriac prototype, Naʒarya. We venture to suspect that the change was not quite accidental, that there was intention to lead away the term from the original telltale form. Be this as it may, it seems indisputable that the sect of the Nasaraioi existed "before Christ."

Possibly, however, some one may plead that the *name* Nasaraioi (or at least Nazōraioi) was not assumed till after Christ. Epiphanius seems to hint as much, though not affirming it expressly. He says that the Jessaioi, to him evident Nazōraioi, having merely heard the name of Jesus and witnessed the apostolic wonders, believed on Jesus and applied to themselves the name Nazōraioi, knowing him as of Nazaret. Perhaps no one would take this seriously or expect us to waste words in exposing such an absurdity.

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[9] In Josephus we find two allusions to Nazirites: Ant. IV. 4, 4, and XIX. 6, 1. In the one the form is Ναζιραίων, in the other it is Ναζαραῖοι. But this latter is found in a parenthesis that needs no critic's eye to detect it as the explanatory insertion of a later hand.

That these sectarians, scattered over a wide region, were at once converted and changed their name in any such manner is absolutely unbelievable and preposterous. Besides, it offers no explanation of the fact that the Nazaraioi were a Jewish sect, already treated as such by Epiphanius himself (see *supra*), and under the name Nasaraioi certainly pre-Christian. We do not of course deny that Nazōraioi may be a later Christian modification of the earlier name. Amid all the nebulosity then of this testimony, one fact shines out clear and unmistakable, the pre-Christian name and existence of a sect that gave the common designation to the earliest Christians, a name that Paul himself did not repudiate, and that still denotes them in the land of their origin.

Surely, no one will contend that these trans-Jordanic sectaries derive their name from the unknown "city called Nazareth," in Zebulun. They are never in any way associated with Nazareth. It is equally clear, as already shown, that they were "not Nazirites," the sanctified. Whatever they were, their early existence explodes the etymology of Nazarean as inhabitant of Nazareth.

None the less the question recurs, Whence their name? The only answer we can imagine is the one already given, which derives the epithet from the Root N-ȝ-R (preserve), but leaves the exact force of the termination undetermined. For the Epiphanian derivation of Jessaioi from Jesse perhaps none will contend; far more likely the Epiphanian alternative, which relates it to *Jesus*. The two Hebrew words ישי and ישו would yield the Greek Ιεσσαιοι with almost equal readiness. For the double σ we may remember Μεσσιας (J. i. 42, iv. 25) for משיחא. However, this and kindred topics we do not broach at present but hold in reserve. It cannot escape observation that the notions of Saviour (Jesus) and Preserver are very close kin, so that the antecedent probability seems very high that the Jessaioi and the Nasaraioi were nearly identical,—the terms Jesus and Naȝaraios seem almost equivalent.

It must be added that what we know of the Gospel of the Nazareans, from the fragments edited by Hilgenfeld, is consistent with the notion that they worshipped originally not a man but an aspect or person of the Godhead. The account of the conception and birth

is wanting, and, what is most important, the Holy Spirit is made the mother of Jesus—in perfect accordance with Hebrew modes of thought, or at least forms of speech, for רוּחַ is feminine, only rarely masculine: "Just now my mother the Holy Spirit took me by one of my hairs[10] and bore me up to the great mountain Tabor," quoted twice by Origen (in Ioan. Tom. II. 6, in Jerem. XV. 4) and twice by Jerome (in Mich. VII. 6, in Is. XL. 12). Hereby the human birth and nature appear to be positively excluded. Similarly the nearly related Ebiōnaioi, at least some of them, declared "the Christ to be Adam, the first fashioned and inspired by the inbreathing of God; but others among them declare him sprung from above, a spirit created before all, both above angels and lording over all, and called Christ, who by lot held the Æon yonder. And that he comes hither when he will, as also he came in Adam, and appeared to the patriarchs, clothed with the body; and having come to Abraham and Isaac and Jacob, the same came in the last days, and put on the same body of Adam, and appeared man, and was crucified, and rose up, and ascended. And again, when they will, they say, No! but into him came the Spirit, which is the Christ, and put on him that is called the Jesus." (Ep. XXX. 3.)

There is much more like the preceding, but so much is enough to show that these very earliest and even pre-Christian sectaries thought of the Christ and the Jesus as supernal and superhuman beings, as deities or phases of deity. These also used apparently the same "Gospel according to Hebrews," written in "Hebrew" and more or less resembling our Matthew, but without the first chapters. Epiphanius has further information that they have also the Johannine Gospel, and even Acts, "translated into Hebrew" and preserved in the treasure-houses at Tiberias—more likely that they had parts of these scriptures in Aramæan originals. Harnack himself declares (DG ⁴I. 293), "these gnostic Ebionites have preserved very archaic matter."

[10] The idea may seem grotesque to us, but not to the Oriental. Compare Ez. viii. 3, the fire-form "took me by a lock of mine head; and the spirit lifted me up...."; Bel and the Dragon, v. 36; other transports by the spirit are most probably to be conceived as effected similarly: Ac. viii. 39, Herm. Vis. I. 1, 3, II. 1, 1-4, Asc. Is. vi. 14, 1 K. xviii. 12, 2 K. ii. 16.

Look at it then under what angle we will, there is one momentous fact that confronts us:

The name Nasarean antedates our era and attaches itself both in form and meaning to the Old-Semitic stem NaȜaR (preserve).

WILLIAM BENJAMIN SMITH.
TULANE UNIVERSITY, 25th October, 1904.

ADDENDUM.

Further examination of the great Paris *Zauberpapyrus*, as edited by C. Wessely, discovers the epithet in question embedded in a mass of glossolalian galimatias, at line 1548:

> "ορκιζω σε κατα του
> μαρπαρκουριθ· νασαα
> ρι· ναιεμαρεπαιπαρι
> . . . . . ."

That νασααρι is our Νασαρια hardly admits of reasonable doubt in the mind of a student of this extraordinary document.

Wessely dates the manuscript, along with Parthey's first Berlin Papyrus, from nearer 300 than 400 A. D. But he recognises, of course, that "the text of our papyrus is not original." All the phenomena, both of matter and of form, point to *ein höheres Alter*, where the adjective will bear an acute accent. Some of the text is avowedly transcribed from "the very old papyrus," the abundant scribal errors imply "a rather long written tradition," and the general atmosphere is one of antiquity.

That the glossolalian passages stand closely related to the "Tongue-talking" of New Testament times, is a proposition that we hope to establish in another connection. W. B. S.

TULANE UNIVERSITY, 22d December, 1904.

THE PASSING OF SCIENTIFIC MATERIALISM.

ATOMISM AND THE ETHER.

FROM the earliest historic times, thoughtful minds have addressed themselves to the problem of the composition and the ultimate nature of the external world. When the phenomena of experience have been thought as inhering in substance and the attributes by which substance is known are projected outward as objective, not only to *myself*, but also to absolute subjectivity, that is, when the objective phenomena are regarded as having an independent external existence, the next step is their unification into an objective world. This dualism between an absolute subject and a universal object is one that pervades all thinking, simply because it is the first product of thinking.

Practically, we know the external world as a succession of phenomena appearing as different modes in extension. These three categories of our knowledge, time, space, and mode, are necessary forms of our thought. The process of cognition is a process of integration, the final extreme of which is the production of an external unity to correspond with the internal unity of self.

As certain phenomena are affirmed as attributes of a substance, all attributes are integrated as a totality of substance in a unity, which is our world of experience. This we philosophically construe as the universe. Just as the few and disconnected points of irritation in the retina are blended into a field of view without breaks or lacunæ, when reflected on the consciousness, so the paltry, scattered reactions upon the *sensorium commune* that make up our individual experience are reported in our thinking as a continuous

extended world. There are no breaks in it. Nature, our nature, abhors a vacuum.

This thought of an external continuum may be derived from a peculiar and very "fortunate" limitation of our knowledge. There is, e. g., no mechanism for perceiving an hiatus in inner experience. Temporal relations are all dynamic. Rip Van Winkle might extend his sleep twice ten thousand times its reported length, but, on awakening, he could know nothing from inner testimony. Inner experience is, and must be, a continuum. Outer experience is reported in the same terms.

Again, space is constructed out of temporal (successive) elements by psychical geometry. The angular deviation of eyes, recorded as muscular sensations of accomodation and similar movements correlated with successive experiences related to these sensations, are connected with the formation of space conceptions, whatever the intuitional school may postulate as something prior to this creation. Space becomes a continuum; therefore, it is a geometric and not an arithmetical construction.

In the case of mode, the idea of a continuum is later in arising. for black is contrasted to white as distinct from, or even opposite to, the latter; and it is only later that we arrive at the apparently paradoxical result that all white is more or less black, and black is somewhat white, and that intervening colors express in their own way a sliding scale of intervening values.

This last analogy is misleading, for it is in the series of excitations and not in the sensations that we find a continuum. The two fundamental forms of mode are identity and unlikeness or dissimilarity. Mode is our reaction to the filling of our forms of space and time,—the latter directly, the former as reflected in objectivisation.

In the long run, therefore, all of these necessary categories of our thinking help us to form an external unity or world, after which metaphysics postulates it as a universe or sets upon it the seal of the absolute.

Science sets forth with the utmost confidence to make conquest of this external world, but only, so far, to return to the stronghold

of individualistic experience, humiliated and baffled. We do not know, and can make no adequate expression for, the reality which constitutes this world of ours. Three characteristics are, indeed, given by the necessities of constructive thinking: the world is unitary, it is continuous, it is dynamic.

All attempts to evaluate the world of experience may be said to fall in one or other of three classes, as follows:

1. *Atomism.* Some minds are arithmetical. All quanitative relations are thought as numerical. All wholes are conceived as made up of units. A world must for them be the sum of all the units of experience, and these must correspond to external units. Such units, since we detect in them relations of "more and less," must be divisible into smaller units; but there will be no point at which they will disappear, but there must be a lower limit of divisibility. By such reasoning, we arrive at indivisible units or atoms, in which inhere all the properties or attributes of the world as a whole, or of various things in particular.

2. *Plenism.* Other minds are geometric and conceive of quantity as continuous. Units are artificial measures of quantities, which increase or decrease by infinitessimal amounts, that is, by continuous activity. The qualities or attributes of the world or of things in particular are only explicable as inhering in a universal substance, co-extensive with the universe and capable of manifold forms of expression.

This interpretation finds many fatal defects in atomism and points out that atoms acting across empty spaces violate the necessities they were invented to satisfy. If acting requires to inhere in a substance, what becomes of activity when passing through a vacuum from one atom to another? In vain, atomism borrows ether from the plenists to fill the chinks between the atoms. The geometrical school states that a plenum or universal substance fills all space and that activity resides in it and is propagated through it. It is even possible to invent mathematical expressions for the individualised manifestations of the activity in the plenum, such as may be studied in the discussion of the vortex atom.

3. *Energism or Spontaneity.* The two schools already named

have shared the honors and divided the field of physics between them. No other possibility has been recognised till lately by modern physicists. These two schools have in common a philosophical postulate, which is not supposed to require proof—and this is very fortunate indeed, for it could never secure it. This postulate is that all activities or attributes must reside in something which is not active. This matter is the physical substitute for the philosophical or psychological construct, "substance." It is by nature unknowable, for it could only be known by its properties or activities. But we do not know them as properties of *it*, but create *it* to explain the continuance or reappearance or relations of the activities.[1]

Activities are discovered to occur in my mind in certain relations, and these relations are the basis for a postulate called "matter." So fixed is the idea that attributes inhere in something, of which they are attributes that language almost refuses to describe any other possibility. But the energist or advocate of spontaneity demurs to this conception as irrelevant. Why should we postulate the unknown to explain the known? True, "standing in relation" is the most important thing about activities. Activities cohere in relations of sequence and similarity, but why invent a matter, entirely unlike the activity and unthinkable apart from the activity, as its ground?

The efforts of physicists have so far failed to afford a consistent and rational explanation of, or expression for, either atom or plenum. The nearest approach to such expression, mathematically, is inconsistent with either and would apply better to activity freed from the limitation of plurality and discreetness imposed by atomism, on one hand, and the impossible combination of imponderability and elasticity, on the other. When the plenists ask us to conceive of gravitation as the effect of an ether itself imponderable, we are fain to seek the camp of the atomists, who speak of ponderable points acting on ponderable points through imponderable space—or to abandon both.

[1] Lord Kelvin defines matter as the rotating parts of an inert perfect fluid, which fills all space, but which is, when not rotating, absolutely unperceived by our senses.

The energists claim that there is no need for either conception, but that substantiality is expressed by relation among activities. Activities are positive realities whenever they are shown to belong together. The belonging-together is the substantiality sought, and to seek further is illogical. A relation is a real thing and expresses a law of organisation. The organisation is the organism. We talk about cold *iron* and hot *iron,* because, of the group of properties we connote under the word "iron," certain ones are observed to vary, and others are, relative to our means of observation, constant. Strictly, however, we should say hot-iron, cold-iron, and cold-hard-black-smooth-iron and hot-softer-grey-rough-iron, etc., as our knowledge of the variables grows. What, after all, makes "iron" a species by itself as against other aggregates of properties called copper, etc., is an organic coherence or belonging-together.

To the spontaneity school have usually belonged philosophical minds who have refused or been unable to attempt an application in detail of their system to the practical needs of human science. Even the practical men who recognised the philosophical correctness of this standpoint, were constrained *in praxis* to use the language of practical physics and chemistry. Hegel's ideas and Schopenhauer's *World as Will and Idea* have never found a place among the symbols of the chemist or the formulæ of the physicist.

After the few introductory words, we may take up the teachings of the three schools more in detail.

THE ATOMIC HYPOTHESIS.

The most complete account of the opinions of the ancient atomists is to be found in the works of the Roman poet Lucretius. Democritus was the founder of the atomic theory as we know it, though it is probable that the two ideas of nature as a plenum and of an infinity of indivisible parts had existed in the philosophical systems of Egypt and India at a much earlier date. Whether we regard the atomic theory as a result of an arithmetical way of treating quantity, or as a product of experience in which the divisibility of units into still smaller units is experimentally realised, it has nevertheless appealed to a certain class of minds with irresistible

power in all ages. The atomists made the distinction between matter and space, and regarded the atoms as indivisible particles of matter scattered in space. The physical analogy is a mass of sand, in which the particles may be all alike, at least in some respects. The necessity for voids was a supposed result of the necessity for motion.

> "Quapropter locus est intactus, inane, vacansque
> Quod si non esset, nulla ratione moveri
> Res possent; namque, officinum quod corporis extat,
> Officere atque obstare, id in omni tempore adesset
> Omnibus: haud igitur quicquam procedere posset,
> Precipium credendi nulla daret res."
>
> *De Rerum Natura*, 335.

The atoms of Heraclitus are indivisible units differing in size, form, and weight. All changes in nature reduce to changes in place or aggregation of atoms. The atoms group themselves in various complexes more or less analogous with the modern molecule, the differences in which result from the diversities in the arrangement of the inherent atoms. Aside from atoms, there is only empty space, but this space has an objective existence, although called the non-existent as contrasted to the atoms as the existent. Democritus himself says that the existent is no more real than the non-existent, a statement which reminds us of the famous Hegelian aphorism that being and non-being are the same. Perhaps, it is to be explained that the agent and the sphere for the activities of the agent are two equal necessities of thought, or that one cannot think of phenomena apart from the limitations that define and make possible the recognition of these phenomena.

The atoms were supposed to be in continuous motion among themselves and to group themselves temporarily in accordance with uniformities or harmonies in such motions. But, as the activities of atoms are, after all, unexplained, a principle is postulated which has generally been termed necessity, ἀνάγχη. This is more like what we have called "ground" and may represent an implied organism—a view that may, perhaps, seem supported by the atheistic tendencies of the atomists.

Anaxagoras supplied the corrective by substituting for necessity the νοῦς or *Nous,* the conscious activity, a teleological principle. This gives to the atom the attribute of spontaneity and forms a link with the energic school. For Anaxagoras the atoms were innumerable, simple, inert bodies in chaotic distribution, until set in activity by the *Nous,* which, accordingly, arranges them into an orderly universe or organism.

In many respects, the monadology of Leibnitz resembles atomism. In making the idea of substance the foundation of his philosophy, Leibnitz resembled Spinoza, but Leibnitz was arithmetical, while his predecessor was geometrical. The substance of Leibnitz, while a living activity, activity being the very nature of substance, finds individual expression in a multiplicity of active monads, each different from the other and each an indivisible point. In this respect they are like Boskovitch's atoms, but, in reply to the objection that no number of unexpected points would make an extended universe, Leibnitz replies that space has no objective reality, it is only a vague subjective concept.

The monad is not only active, it is also living. Each monad is a microcosm and mirrors the universe. It is fundamental to Leibnitz's system that the activities of every monad imply those of all others. These activities, as related to individual monads, are repulsions, but they unitedly form an equilibriated whole. All things are compounds if monads. Matter in the usual sense does not exist. Each monad has a certain mentality in attribute and a certain vague or clear consciousness. The equilibrium of all these conscious activities is the perfect divine reason. While monads do not affect each other directly, they move in a state of equilibrium in which one is reflected in all and all in one,—the pre-established harmony.

Boskovitch, like Leibnitz, regarded atoms as mere centres of force, the result of whose coexistence is that no two atomic centres can approach each other within a certain distance. This approaches to energism, but Boskovitch's atoms have position in space, are capable of motion, in a continuous path, and possess a certain mass, so that a certain amount of force is required to produce a change of motion. The atom is endowed with a potential force, and two atoms

will repel or attract each other, with a force depending on their distance apart, and, for distances greater than about one-thousandth of an inch, this attraction varies inversely as the square of the distance, while the law of repulsive force is not known. The ultimate force is repulsion which increases without limit, as the distance increases without limit, so that no two atoms can ever coincide. All action between bodies is action at a distance. No such thing as contact between bodies occurs in nature.

Swedenborg seems not only to have adopted an atomic hypothesis, but to have anticipated modern stereo-chemistry, by suggesting various geometrical groupings of atoms as causes of the peculiarities of the resulting molecules.

When Boyle and Lavoisier had developed the idea of elements and elementary discreteness, the idea of the atomists, which had been revived by Gassendi, was seized upon by Newton to serve in his physical speculations. The establishment of the fact that for any given portion of matter extension is variable but mass is constant, made the adoption of some form of atomism inevitable.

Bryan and William Higgins developed the atomic hypothesis along theoretical lines. The former, in 1775, recognised seven elements composed of "atoms homogeneal, impenetrable, immutable, in figure inconvertible, and globular." William, a little later, promulgated the idea of the union of atoms to form molecules, though he was unable to formulate the quantitative law for their union.

To Dalton, more than to any single writer, perhaps, we owe the formulation, in acceptable form and with convincing data, of the atomic hypothesis in its modern dress. Dalton was undoubtedly greatly influenced by Newton's corpuscular emanation theory, and his opportunity was due to the work of many others, through whose labors the constancy of matter had been postulated, elements had been differentiated, and the beginnings of pneumatic chemistry made. When studying the diffusion of gases he was impressed with the idea that atoms of different substances must be different in size. Upon applying this hypothesis in chemical problems, he discovered that for each element there is a definite combining value, i. e., that a relative weight of its atom could be assigned. It was

known prior to this time that substances unite in definite proportions. The law of definite proportions found its explanation in the impossibility of dividing atoms, so that the resulting weights of a compound must contain the weights of the uniting atoms as factors.

The atomic theory, as formulated anew by Dalton, which portrayed chemical union as a juxtaposition of atoms, co-ordinated the known relations and gave to chemistry a quantitative basis or law. The tables of Richter and Fischer supplied materials, and the new formulæ of Berzelius assisted to make the new system practicable. Dalton's tables of equivalents were rough approximations, and his own success as an experimenter was limited, but he opened the way and devised the method which, in the hands of Berzelius, who supplied what Dalton lacked, became fruitful, and the new notation grew more complete and was soon generally accepted.

Physicists were, naturally, quite as much interested in the constructions growing out of the atomic hypothesis as chemists, though both were for a while profoundly influenced by the metaphysics of their time. When Gay-Lussac, in 1808, the same year as the publication of Dalton's *System*, showed that combination between gases always took place in simple relations by volume, and that all gaseous densities were proportional either to the combining weights of the several substances or to rational multiples of them, the new era, the era of gaseous physics, had opened. Avagadro generalised the facts and formulated the law that bears his name: "Equal volumes of gases, under like conditions of temperature and pressure, contain an equal number of molecules." The distinction between atoms and molecules (the smallest aggregate of atoms in combination) requires to be constantly in mind, or the mistakes of the earlier chemists and some later physicists may be repeated.

To the above must be added the following: *Boyles Law*: "In a given mass of any gas kept at a constant temperature, the pressure per unit of area upon the containing surface increases in the same proportion as the volume occupied by the gas is diminished." *Charles's Law*: "If the density be constant, the pressure is directly proportional to the temperature measured from the absolute zero, —273 centigrade." *Dalton's Law*: "In a mixture of gases, when

there is an equilibrium, each gas behaves as a vacuum to all the rest."

It was at one time believed that these phenomena could be explained by recourse to mutually repulsive forces acting between the parts of which the gas is composed (molecules and the like); but experimental proof has been offered that not repulsion but attraction exists between molecules. Regnault, for example, by observing deviations from Boyle's law when the density of gases is greatly increased, showed that the pressure is less than that law requires, indicating that the interfering force is attractive. Joule and Thompson conducted experiments on the thermal variations during expansion of gases which also showed that the forces between molecules, though small, were actively attractive.

Such considerations led to the kinetic theory of gases, which explains the intrinsic energy of a gas as not residing in the potential energy of intramolecular forces, but mainly in the kinetic energy of the molecules themselves, which are assumed to be in a state of continual relative velocity. The physical theory of heat compels us to regard the intrinsic energy of any gaseous mass as dependent largely upon temperature, so that it follows that, if this intrinsic energy is found in the form of kinetic energy of the moving molecules, the average kinetic energy of the molecules throughout the mass must be a function of the temperature. When several kinds of molecules are in motion and acting on one another, the mean kinetic energy of a molecule is the same whatever its mass, the molecules of greater mass having smaller mean velocities.

If equal volumes of two gases are at equal pressure, the kinetic energy is the same in each. If they are also at equal temperature the mean kinetic energy of each molecule is the same in each. If, therefore, equal volumes of two gases are at equal temperature and pressures, the number of molecules in each is the same, and, therefore, the masses of the two kinds of molecules are in the same ratio as the density of the gases to which they belong.

It is not necessary to go into the processes by which the size and velocity, as well as the mean path, of the molecule have been calculated. The mean path of a molecule of hydrogen is given at one 10,000th of a millimetre. About two millions of molecules of

hydrogen would form a row a millimetre long. Since the molecules of organised matter are very complex and so much larger than molecules of hydrogen, it has been computed that about two million molecules of organic matter might constitute a fragment visible under a microscope. If these conceptions were true, they would have an important bearing on those theories of heredity that require for their application the existence of pangens, micellæ, ids, or the like. The size of the resulting germs would, upon the above calculations, soon become quite unmanageable and impossible. Of course, we shall see later that, even on the atomic hypothesis, we may be dealing with ultimate particles (electrons) a thousandth the size of the atom, so that the "ids" *et id genus omne* again find a realm for their imagined operations.[2]

When we assume that atoms of every pure (unmixed) substance are all alike among themselves, then Dalton's law of multiple proportions follows of necessity, and all relations of mass in chemical compounds must be regulated by the masses of several atoms. There exists, then, for each element a definite number, which expresses the quantity of that element that may enter into compounds. These numbers for the various elements are relative, or are really ratios. These numbers are the combining weights, or more properly, the combining masses of the elements, and are commonly but incorrectly called the atomic weights.

While, nominally, these atomic weights express the ratio of the combining weight to that of hydrogen, assumed as unity, for practical reasons the assumption is made that oxygen has a weight of 16 as compared to hydrogen, and the comparisons are made direct with oxygen and reduced to a theoretical unity on that basis. As a matter of fact, if O is 16, H is about 1.003 or 1.005.

A very important corollary of the atomic hypothesis was that suggested by Prout in 1815 and elaborated by Meinecke in 1817. Prout believed that there is a fundamental substance or protyle out of which the various atoms are formed by union in various proportions, etc. Hydrogen he at first supposed to be, or to contain, the

[2] An interesting discussion of methods for determining the size of molecules is given in Risteen's *Molecules and Molecular Theories.*

protyle, and, as a consequence, it was assumed that the atomic weights of all elements must be multiples of that of hydrogen or some aliquot part of it, i. e., of the protyle composing it. Thomas Thompson disseminated this idea in England, but, in fact, it is a suggestion which will occur of itself to every thoughtful student of chemical quantities.

Dumas and Stas found errors in the work of Berzelius and showed that the ratio of carbon and hydrogen is as 12 : 1 and that of nitrogen to hydrogen as 14 : 1. This seemed a long step toward experimental proof of the protyle theory. The result of the most careful quantitative work so far does not support the supposition, and Dumas was obliged to divide the weight of hydrogen by 4 in order to secure the desired factor, and this is so small a number as to be quite within the range of experimental error in determining the atomic weights by present methods. It will be seen later that recent results seem to indicate that the factor may be hydrogen divided by 1000, not by 4, so that this difficulty is not so serious as was supposed, provided we accept the electron as the modern representative of the protyle.

However, there is a real approximation to such a relation as Dumas supposed. Out of 67 elements whose atomic weights are fairly well known, 38 are whole numbers or different from a whole number by no more than one tenth. It will be noticed that quite recently the doctrine of the protyle is rendered probable in another form. The so-called electrons, which are supposed to be vastly smaller than atoms, are found, by the best evidence yet available, to have the same mass, whether derived from the atom of one substance or that of another with a different weight. Moreover, there seems to be reason to suppose that atoms or molecules may become so complex that the internal strains cause them to be unstable, as in the case of radium, and that these protyles are given off incessantly without appreciably reducing the mass. If this spontaneous decomposition be assumed and the materials given off are manifoldly smaller than hydrogen atoms, then no experimental verification of the proportional relations of the protyle to the atom

could be expected in the usual channels, and the objections to the hypothesis in the new form disappear.

Another set of corespondences has given rise to what is known as the periodic law. J. B. Richter, as early as 1798, made some suggestions in this line, and soon after the atomic hypothesis was formulated, Doebereimer called attention to a certain regularity in the series of combining weights. Pettenkofer tried to arrange the atomic weights of similar elements in arithmetical series, Lenson hoped to group all weights in triads, and, later, Newlands announced the law of octaves and enjoyed the ridicule that usually attends the premature recognition of a new fact. Finally, Lothar Meyer and Mendeljeff contemporaneously (1869) announced that properties of elements are periodic functions of their atomic weights. In this way, curious analogies in mathematical proportions were brought into relation with similarities in the properties of elements. A very remarkable regularity occurs with respect to the valency of the elements. An indication that the discovered correspondencies have some counterpart in nature is found in the fact that Mendeljeff was able to predict in advance the characters of elements to fill the vacant places in the series; and these predictions were verified to a considerable extent on the discovery of the corresponding substances.

Difficulties in applying the law of Gay-Lussac to compound gases like HCl led eventually to the recognition of the theory that atoms in a gas join to form groups called molecules. Gay-Lussac's law, therefore, runs: "The specific gravities of gases stand to each other in the ratio of their molecular weights."

The molecules in a gas are supposed to be moving in all directions with very different velocities and are continually encountering each other. The molecules will encounter each other less frequently the farther apart they are, and all the more frequently the larger their cross-section. The mean free path is directly proportional to the space alloted to each molecule. J. R. Mayer, in 1842, deduced from apparent loss of heat during expansion of a gas and the fact that this expansion in a vacuum does not occasion such loss, the idea that the heat is converted into energy. When the gas is com-

pressed, the work done is transformed into heat. This led to the doctrine of the conservation of energy.

As already briefly alluded to, considerations connected with specific heat and the kinetic theory of gases seem to show that there is intra-molecular energy, which may be conceived as expended in vector, i.e., rotational motions.

A remarkable character of molecules was laboriously evolved from apparent discrepancies in the results of chemical analyses, which seemed to point to different properties of bodies with the same composition. Franklin, in 1852, discovered that one atom of zinc, arsenic, etc., had its combining tendency satisfied by a definite number of univalent elements or radicals of whatever kind they might be. An atom of carbon, for example, can unite with four other univalent atoms or radicals.

With the law of valence a new vista opened before the molecular student. The valences were also found to form a series corresponding to the periodic law. It will be seen that, putting aside the assumption of materiality as a mysterious conveyor of properties or activities, the atomic hypothesis has been the means of revealing a large series of quantitative ratios or correspondences, the value of which to science is something wholly apart from the significance of the material atoms in which these correspondences are supposed to reside. They are all correspondences in force, or, better, in form or amount of energy.

The fact that there were exceptions to the application of the general law of valency, led to a search for variations in the form of the atom to explain the variation. Van't Hoff, in 1878, advanced such a theory. He assumed that the chemical attraction between molecules is due to gravitation, and that, if the form of the atom were other than spherical, the intensity of attraction at the surface would have a certain number of maxima dependent on the form. If the thermal motion of the atom were rapid, only the strongest maxima would be able to retain their atoms, and valency would be greater at a low than at a high temperature, and this is the case.

Van't Hoff extended his theory by formulating a tridimensional space relation for atoms. He supposes the valencies of the carbon

atom, e. g., to act at the four summits of a tetrahedron. Wislecenus has shown that this theory gives an intelligible explanation of the existence of more isomers among unsaturated compounds than indicated by the ordinary structural formulæ.

Although this theory is of the most hypothetical kind, it has been extended to form the foundation of a complicated stereochemistry, the applications of which have also a bearing on crystallography.

We know of no matter without energy, or rather, we postulate matter only from the energy perceived. Energy is defined as of such a nature that *it is not possible for any masses affected with any kind of energy to exist together.* (It will be noted here that the fact that there are "masses" affected by "energy" is assumed without any shadow of proof.)

Mass is used as though it somehow represented "amount of matter," but, in reality, it is expressed in units of a force, and reasons may be given for using energy instead of mass. It is generally agreed to represent kinetic energy by the formula $\frac{v^2}{m^2}$, when m equals mass and v equals velocity of the moving body. Potential energy will then be represented by fs, where f equals force or measure of striving to change place, and s the space passed over by the point considered in the change of state. The general law that in energy the intensity must have the same value in all parts of the system is interpreted to mean that

For kinetic energy velocity equals intensity,
" potential energy force equals intensity,
" heat energy temperature equals intensity,
" electrical energy electromotive force equals intensity;

and that, whenever the intensity varies in different parts of the system, the latter is in a state of unrest until equilibrium is restored. In all these expressions one factor is quantity and the other is intensity; in electrodynamics, for example, the conception is that the quantity of electricity is the real thing at the bottom of electrical phenomena, and the second or electromagnetic force or tension is an intensity. (Whatever value this analysis may have in providing

an expressive terminology, it must be remembered that the real thing is the electrical energy, and that the separation into two factors is as illusory as the dualism between matter and its properties.)

Clausius was led to conclude that some molecules in electrolytes are decomposed in consequence of their collision, and that these parts, being separated, are available to effect the transport of electricity generated.[8] And it was later decided that solutions of salts and strong acids and bases contain these substances largely disassociated as ions. This theory of electrolytic disassociation has proven quite fruitful.

Up to the time of Boyle, the conception of a chemical element was not that of a substance, but of a property or a plexus of properties, so that the presence of an element in a substance was recognised through the possession by that substance of a certain property, and it may well be that little has been gained philosophically by the new idea that elements are undecomposed residues of natural substances.

From the chemical side, the atomic hypothesis seemed well justified. It became a vast and complicated structure, coherent and serving to join in an intelligible system the wonderfully varied mass of facts accumulated by thousands of workers in this field. The brief summary given will serve to indicate the diversity of the problems and the methods of solution. Like gravitation the theory was "proven" and adopted in all the practical work of chemistry and was taught in all schools as an established dogma, and yet, like the theory of gravitation, it is undoubtedly false in its present form. It is a common charge against science that it is lacking in stability and that the accepted theory of yesterday is discredited today. The criticism indicates an entire misconception of scientific

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[8] By Clausius's formula, the free path of molecules has been calculated as, for example, that of oxygen at .00 000 38 in., of nitrogen at .00 000 36 in., of hydrogen at .00 000 67 in. From data so secured, the average number of collisions per second experienced by molecules of various gases at 0 deg. C. and atmospheric pressure, as follows:

Oxygen, 4 410 000 000 per second,
Nitrogen, 5 021 000 000 per second,
Hydrogen, 10 040 000 000 per second.

method. Every theory which serves to bring disconnected facts into harmonious relation has truth in it, and a rejection of a theory in its definite form, after it has served its purpose, is not to discredit its utility. The relations exist and each new theory serves to exhibit these relations more completely, till the approximation to complete harmony, i. e., explanation, is reached.

It became evident when the attempt was made to apply the atomic theory to physical problems that it was insufficient or incorrect. The emission theory of light proposed by Newton, on the basis of the rectilinear factors in its propagation, proved incapable of explaining the transverse vibrations indicated by the phenomena of polarisation, etc. This and many other insufficiencies led to the necessity of recognising an imponderable ether, which, nevertheless, was obliged to possess many of the characteristics of the homogeneous solid; and thus it came about that two contradictory concepts contrived to occupy the field together, and matter was supposed to occupy the same space with continuous ether and to be acted upon by it, while having none of its properties. A third entity, energy, by which alone ether and matter can be known, was postulated as acting upon and through both. Curiously enough, the very power of acting which is all of energy is impossible without ether and matter; and we have the third absurdity of an agent which cannot act alone, endowed with the power to act, when it comes in contact with matter, in which it immediately develops properties which have no active existence, except as acted upon by energy.

These philosophical absurdities are tolerated by those physicists who clearly recognise them, because of the difficulty of providing a practicable substitute for the elaborate systems, which have grown up in the two allied domains of physics and chemistry within the last few years.

Now, having spent a hundred years in founding and perfecting the atomic hypothesis and bolstering it up with etheric creations of imagination, nothing is more characteristic of scientific spirit than that science should make every effort to destroy or replace it. This is the work of the twentieth century.

Newton was satisfied with the solid singleness of the Lucretian

indivisibles, though he too found the ether a necessary adjunct. The defects in the atomic hypothesis are nowhere more evident than in the characters of the so-called ether invented (one can hardly say discovered) by Faraday and Clerk Maxwell. But even after inventing such a medium, it was not found possible to invent properties for it that would satisfy the conditions. A gas will not execute luminous vibrations and the anomalous solid it was once supposed to resemble could have no stable equilibrium. Material status is denied it, yet without it we are told, there could not be gravitation, and yet weight is fundamental to atoms. Without the ether atoms could not communicate. Matter is not conceivable apart from the medium which transmits its activities. Observe here that the very qualities or attributes, by which alone matter is supposed to be known, are "inconceivable apart from this invented ether which has none of them." This sounds suspiciously like nonsense.

This medium is essentially limitless and universal. It is a short step to the denial of this matter which thus plays hide-and-seek with our reason. This Kelvin did by using Helmholtz's vortex ring phenomena to illustrate a kind of atom composed of ether by the isolation of portions of the ether affected by vector motions. Such vortex atoms were found by mathematical calculation to be capable of permanent separate existence, by virtue of the peculiar form of their activities. Their indispensable matrix is a perfect fluid.

By going a little further, Professor Larmor has urged that atoms are foci of etherial strain. But, putting aside the seductions of this line of thought, whose mathematical abstruseness has hindered its popular acceptance, let us pursue the downward career of the atom.

Lockyer urged consistently from the results of his spectroscopic work, that in the furnaces of the sun, matter exists in a still more elementary condition than the atomic. Through what is called the "Zeeman" effect, magnetic phenomena are made to give confirmatory evidence of this suggestion. But it was a result of the investigations of greatly attenuated matter in Crooke's tubes that the evidence became most convincing. When electrodes are introduced into such a glass tube and the air exhausted, till the pressure is, say, one one-

millionth of an atmosphere, an electric current, in its passage, develops peculiar phenomena. It is now borne across the partial vacuum by a stream of particles from the negative pole, and these particles are invisible until they impinge on the glass, when they become visibly luminous or phosphorescent. It is found that the stream is susceptible to magnetic influence, and, for this reason, it is supposed to be molecular. The discharge tends to describe a circle about the line of magnetic force as an axis.

This "matter" was described by Crookes as being in a fourth state, as it does not perfectly obey the laws of solids, liquids, or gases; it is, in fact the so-called "radiant matter." These "cathode rays" pass freely through thin metallic films and discharge electrified bodies by making the surrounding dielectric temporarily conductive. These rays also affect photographic plates.

Oxygen, at one-sixteenth pressure, is exactly as permeable to cathode rays as is hydrogen at normal pressure; and this fact is very significant.

"Roentgen rays" are also produced by bombardment of walls of vacuum tubes by radiant matter, but are enormously penetrative of many opaque substances. They cannot, however, be diverted from their paths by magnetic influence. For this reason, cathode rays are said to be corpuscular, and Roentgen rays are etherial, movement alone being supposed to be transmitted. Here, however, is a case where the properties of the two things are exceedingly similar and the fundamental distinction between the behavior of material particles and etherial vibrations breaks down. We may be forgiven for doubting the existence of such fundamental distinction, at least in this case.

But, returning to the cathode ray material, it is concluded that it is composed of neither molecules nor atoms. Whatever the kind of gas in which they are produced, their properties are identical. Perhaps we have here the "protyle" or primeval material—the *Urstoff* of earlier speculative physicists.

These infra-atomic elements can only be produced by means of electricity and are always "charged," and this lends plausibility to the description by J. J. Thomson of cathode rays as "convection

currents" of electricity. He adduces reasons for believing that these "corpuscles" are one-thousand times lighter than hydrogen atoms, and that they form "invariable constituents of the atoms or molecules of all gases and presumably of all liquids and solids." If these are ultimate electrical units, the name "electrons" is appropriate for them. A confusion often arises here by employing "ion" for "electron," and physicists speak of "ionising" the air. Gases are 'ionised," when their molecules are broken up into smaller particles or ions, each associated with an electron. The electrons have the power of electrical conduction. Ideas here are as yet very hazy, and the minute discussion of them here would be unprofitable. Perhaps, the tendency represented by Larmor to believe that an atom is an aggregate of electrons in vector motion, that its mass is proportional to the number of these constituents, and that the interatomic forces are electrical, is now in the ascendent.

These suggestions might have been relegated to the limbo of defunct theories, but for the startling and rather disconcerting discoveries, in connection with radiant matter, recently made in uranium compounds and related substances. Uranium, thorium, and radium have the highest of known atomic weights, and this fact suggests that if atomic equilibrium really be unstable, the effects of interference or incipient break-down should be observed in the case of these elements, if anywhere. In fact, the rarity of these metals may be due to the fact that they are unstable and liable to subversion or inorganic decomposition. Radiation, like phosphorescence in animate matter, may be a species of decay.

Electrical tests of radio-activity carried on by Rutherford and Soddy at Montreal promise a quantitative measure of this activity. The ionisation of a given quantity of air was measured by the effect on a constant current, as read by an electrometer. Thus, the leakage of electricity under the influence of the radiations can be measured very accurately and a standard of comparison secured.

Thorium and radium give off continuously three kinds of rays called *alpha* (atomic), *beta* (cathodic), and *gamma* (etherial). The first or alpha rays are believed to be composed of atoms (perhaps of helium) and are charged with positive electricity, and they can be

deflected by a magnet. They move with a velocity of some 16,000 miles per second and are powerful ionising agents. Beta rays, on the other hand, are cathodic, and the particles may be one one-thousandth of the weight of hydrogen atoms. They are positively electric and highly actinic. They are dispersed unequally, forming what has been called a "magnetic spectrum." Gamma rays are believed by Madame Curie to be ultra-luminous vibrations. They are not deflected by a magnet.

Besides the above, the substances above named slowly give off what appear to be gaseous emanations that can be condensed by intense cold. By means of these emanations are explained "induced" radio-activities in objects adjacent to radiantly active materials. These emanations are self-luminous. From experiments so far made, Professor Rutherford inclined to the belief that the alpha rays are really helium atoms and the emanations also behave like this element. It is possible, then, that radium spontaneously decomposes in forming helium at ordinary temperatures.

The production of heat by radium, independent of other source, is a significant fact and has been supposed to show that this element is continually liberating atomic energy.

Hitherto, we have had to do with molecular effects; here it is possibly a case where deeper reservoirs of force residing in the atom have been tapped. If a radium atom contains 258,000 electrons, J. J. Thomson concludes that the diminution of the intrinsic energy of radium atoms by one per cent. would keep up the emission phenomena for a period of 30,000 years. If 3.6 grammes of radium existed in each cubic metre of the sun's volume at the surface, it would be sufficient, according to Wilson, to supply the totality of solar radiation. These guesses serve merely to suggest what a mass of energy may lie concealed, entirely inappreciable to scientific instruments, in the "atomic" structure of the most tenuous gases. A gramme of radium, according to one author, has power enough to raise 500 tons a mile high.

But this fatal quality of dissociation appears to be universal, as Sir William Crookes says. Bewildering as is the mass of new facts and still larger crop of new speculation, it is clear that atoms in the

old sense can no longer be accepted. With the atom, a whole world of varied and enormous activities has been discovered, and the door out has been left ajar so that these forces can no longer be kept sealed. Pandora's box is open and the plague of new speculation is abroad.

The simplest view that can be taken is that the integrity of what we call an atom is in the nature of an equilibrium. Mathematical and physical experience shows that vector motions (rotational energy, etc.) are different from energy in rectilinear or radial translation, and that there may be a high degree of independence between these two sorts of energy, and that two instances of vector motions may mutually influence each other in various phases, depending on their correspondence in time and mode. The solenoid illustrates this point roughly.

Physics is inclined to suggest an electrical force as behind all so-called material phenomena, and the recent results of radium investigation tend to support the suggestion.

Meanwhile, one result is plain: cosmological speculation can profitably go no further than to take the actual data of experience, which gives us only energy in various manifestations, and it is by no means clear that anything will ever be gained by seeking an explanation of the ultimate fact of experience by invented "carriers," "media," postulated to "explain" what is by nature inexplicable. Further discussion may, however, be postponed till we have considered the other material alternative.

"We are acquainted with matter only as that which may have energy communicated to it from other matter. Energy, on the other hand, we know only as that which in all natural phenomena is continually passing from one portion of matter to another."—*Maxwell.*

THE PLENUM.

The defectiveness of any atomic conception of matter appealed to a certain class of minds, from the first. As a mere abstraction, it seemed unthinkable that the continuous translation of force through space could take place if space were but partly filled. Atoms, if capable of independent action at all, required to be separated from

one another by such spaces. Nature, especially as we have said, the nature of the human mind, abhors a vacuum, and it was inevitable that the atomic hypothesis should be substituted for or supplemented by, the concept of a plenum or something filling space completely.

Even Anaximander seems to have had some such idea in his ἀρχὴ or *Urstoff*. This unlimited, undefined, but not immaterial, ground of energy was in so far dynamic, as it possessed the eternal property of motion, but it was not freed from the materialistic tendency of the Ionic school in which it developed. There was a combination of the energic with the plenistic ideas, which were too vaguely expressed to have more than an historic interest.

The plenum of Descartes was something like extension. There are two substances, spirit and matter. The attribute and essence of matter is extension. This dualism was bridged by Malebranche, but there is nothing to explain the nature of the universal plenum. Descartes does explain light as generated by a pressure throughout an infinitely elastic medium filling space. Newton, though advocating a corpuscular theory of light, also taught that heat may be conveyed through a vacuum "by vibrations of a much subtler medium than air," and adds, "is not this medium the same with the medium by which light is refracted and reflected?" He also employs the ether to account for gravitation. Hearing and animal motion he also supposed to be brought about by the vibrations of ether.

The theory of the ether, as now universally taught, results from the necessity felt for a medium to transmit energy from point to point. Light, for example, moves at a finite rate from the source of generation, and, in as much as the phenomena of destructive interference seem to forbid the idea that light is a substance emitted from the luminous body, as held by Newton, the only recourse was to postulate a medium of some kind in which disturbances may be propagated in all directions. We have the analogy of sound. Sound waves are not propagated *in vacuo*. It requires a medium, in this case air or some fluid or solid substance. In like manner, it is supposed, there must be a medium for the light, heat, and electrical vibrations.

Huygens is credited with being the real inventor of the etherial hypothesis in its present form, and it cannot be denied that the doctrine has been most fruitful. The present tendency is perhaps to consider even the phenomena of matter itself as manifestations of energy stored in ether. Potential energy is considered to be energy stored in the ether and may be simply motion of the ether, so that all energy will be found to be, as it theoretically must be, kinetic.

Two properties must be assumed to satisfy the conditions, for which ether was invented, viz., elasticity and density. In the case of a vibrating elastic solid, the energy is half in the form of kinetic energy due to the vibratory motions of the parts of the body, the other half being potential or stored up in the distortion of its parts. It has been found that the vibrations of light are of such a nature as would be impossible to either liquid or gas, so that something analogous to the solid state is required. This state is found by mathematical research to be unstable. It results that the ether has no scientific footing, but has the anomalous status of being something of pure invention, failing to satisfy the conditions which alone led to its invention.

As a matter of fact, all the discussions of wave phenomena would be just as intelligible as they now are, if the idea of ether were eliminated. Or, rather, this would be the case if the mind would disabuse itself of the analogy of water and sound vibrations, which seem to require a medium. Here the more suitable expression is that waves of sound are alternating forms of activity recognised in conditions satisfied when vested in what we call liquid or other matter. It must not be forgotten that the energy involved in sound is not lost, when the sound wave is prevented from proceeding by an interposed vacuum. Its critical point is reached, and it assumes another form. These modes are really expressions of interference of forces, residing, as we are wont to say, in the forms of matter called media for sound waves.

Optics talks of the kinetic energy of a vibrating particle, distribution of energy in the case of a medium disturbed, etc. All of these concepts lose nothing if divorced from the idea of a medium.

A study of electro-magnetic phenomena has been used to fortify the ether hypothesis, and, by a curious fatality, it now seems that its perfection will but serve to complete the overthrow of that theory. The ether about an electrified body is supposed to be affected or thrown into activity. When thus active it is polarised. When the body is discharged the activity ceases or is dissipated. Alternating electrical charges are accompanied by changes of state or vibrations of the ether, and, if the charge be varied periodically and with sufficient frequency, we have a vibration at each point analogous to, and perhaps identical with, what occurs in the propagation of light. Light and heat waves have been reduced to the same category, both being waves of electrical polarisation. Professor Hertz's experiments related to oscillating discharges having a period of about one 30,000,000th of a second, and reflection and interference of electro-magnetic waves are ingeniously brought within the sphere of observation. Reflected waves interfere with direct waves as in the case of sound. Most of the experiments usually carried out with light and heat waves were successfully tried with the electro-magnetic vibrations. From the mode of production, it follows that these vibrations consist of transverse vibrations, and that they are plane-polarised. Without carrying out the comparisons between the electro-magnetic and light vibrations further, we may add that, according to the electro-magnetic theory of light, the vibration is a transverse periodic disturbance attended by electric force in one direction and magnetic force in the perpendicular direction. Comparison of velocities and refractive indices reveal the required harmonies. The original conjecture of Faraday (*Experimental Researches,* 3075) that the electro-magnetic action may be a function of the ether, seems about to be confirmed, except that by the ether we are brought no nearer to a solution of the general problem.

Even if the difficulty involved in the supposition that an elastic or compressible medium must be discontinuous be ignored, and we assume that a medium may be homogeneous and continuous as regards density, and yet may be really heterogeneous by virtue of its motions, as in the case of the vortex atom, in a perfect liquid-solid, still are we no better off with our medium than we would be, if we

substitute energy, instead of mass, in our equations and do away with the material element and medium altogether.[4]

There is an important fact which physical theorists are prone to forget, and, by neglecting it, are led to state hypotheses as proven facts, viz., we cannot know atoms or molecules individually, but, if at all, *only in the aggregate,* and what we infer of their structure must be by observing, experimentally, the gross results of their interaction in masses. For example, according to Avogadro's law, there are simple volumetric relations among gases when they combine. The densities of gases are proportional to their molecular weights. But the statement of Avogadro's law, in the usual way, that "all gases (conditions being the same) contain the same number of molecules per unit of volume," is pure hypothesis, yet it passes in physical literature as "established fact." The question of the nature, nay of the existence of molecules, is begged throughout.

Any theory, molecular or otherwise, which can acceptably *explain* the constitution of the physical universe, must bring into harmony the different facts which pass under the names *inertia, elasticity, attraction,* and *stability.* But, by explaining, we do not mean the clearing up of the ultimate *why* or the final *what,* but the arranging of all the facts in a congruous system which is the ultimate

[4] An illustration of the tedency of modern physics in relation to the concept of materiality, is given by Drude's *Lehrbuch der Optik,* which is devoted largely to the mathematical development of the electro-magnetic theory of light. In this work we find such expressions as "The vacuum (the free ether)," "the velocity of light in empty space (the free ether)," and the following more definite statement: "The concept of the absolutely quiescent ether is most simply and naturally expressed if we understand by ether, not a substance, but simply space provided with certain physical peculiarities." The naïve innocence of metaphysical taint in this statement, where space is supposed to be clothed with certain physical attributes, may seem amusing, but we see at least a recognition of the difficulties inherent in the postulate of material media. The magnificent hypothetical structure erected by H. A. Lorenz (*Versuch einer Theorie der electrischen und optischen Erscheinungen in bewegten Körpern,* Leiden, 1895) rests on the assumption that the ether is always in complete state of rest. The chief value of the electro-magnetic theory is that no special assumptions are necessary for the propagation of light, but its laws follow directly from those of electric and magnetic forces as already worked out, or, as Drude says, "It does, indeed, represent a remarkable advance in natural science when two hitherto unrelated realms, like optics and electrical science, are brought into relations by mensurable control."

how. The dynamic view is that the complete comprehension of the *how* is all that we can ever know of either *what* or *why*. It is not sought to "unify the conception of chemistry and physics and consolidate these sciences into one grand science of matter," as suggested by Risteen, but, on the contrary, it finds the essence of things in their behavior and is satisfied, if it may continually approximate to a knowledge of the forms of these activities, which to know is to *understand* the physical universe. Nor does one doubt that the energy which finds expression in material terms is, in last analysis, of one kind with that whose complex trajectory is interpreted in consciousness.

When the physical demonstrator by means of a box punctured on one side and furnished on the other with a taut membrane, by tapping on the membrane, projects smoke rings across the room and shows us how the smoke curls in vortex-flow along the axis of translation and how two such rings may be made to interfere and intertwine in most complicated fashion, he is careful to tell us that the smoke which we see performing these amusing antics has nothing to do with the phenomena, except to make them visible to us. The vortices would be there just the same, if no smoke were in the box. So when the vortex atom, which comes the nearest at present to affording a scientific concept of the physical unit, is introduced, Lord Kelvin is careful to exclude from the ether, in which such atoms are supposed to exist, all material postulates. It must have the character of a *perfect fluid*. Thus, we see the postulate of materiality is but the smoke for making the vortices comprehensible to the lay mind. A brief analysis of the vortex-atom, or, better, the vortex unit, will make this clear.

1. Helmholtz, in his definition of vortex units by mathematical process, showed that the fluid in which such vortices exist must be frictionless, homogeneous, and incompressible. Such a combination is incompatible with what we are supposed to know of matter, but granting these conditions, a vortex could never be produced or destroyed in such a medium, and it follows that it would be conserved forever, or that it would exist as long as the medium continues.

2. Such a vortex would always contain the same portion of the fluid. It moves as a whole—it is not alone the motion that is propagated, as in wave motion. Thus the energy is doubly identified with the fluid (or conversely) both as to permanence and as to content.

3. Now, compare these points with the definition of matter by Lord Kelvin, the other great student of vortices. "Matter is the rotating parts of an inert perfect fluid which fills all space, but which, when not rotating, is absolutely unperceived by our senses."

If the statements under 1 and 2 are correct, the expression, "when not rotating," is inapplicable; for, if not rotating, this fluid can never be made to rotate, and, if only part be rotating and the rest not, then the part not rotating cannot affect that which is, nor can it be affected by it—it is "inert." If it existed we could never know it, nor could we comprehend in what its existence consists. It would be a case of "pure being," equivalent to "non-being" in the popular nonsense, improperly attributed to Hegel.

We see that the only things which could cause the vortices to affect one another *are their respective activities.* If matter is elastic, it is because there are such things as repellant phases of activity; if there be attraction, it is because certain phases coincide or have congruous periodicities; stability and individuality are inherent in the nature of vortex or vector activities, corresponding to intrinsic or genetic modes; and, finally, inertia is but another name for spontaneity, the last irresolvable, constituent attribute of energy.

It must be noted, in passing, that vortex units are not necessarily vortex *rings.* A better analogy is, perhaps, that of a spheroid of "free path" or field of activity in which the spheroid is tending constantly and in all parts to be everted. A ball continually turning itself wrong side out by a kind of convection motion is a convenient representation. This is a fourth-dimension motion of great mathematical complexity.

Doubtless, every genuine discovery made by the newer molecular physics, however erroneously applied, will find a place in the new dynamic science.

ENERGISM.

What has already been said, while giving but the barest outline of an exceedingly complicated subject, may serve to illustrate the difficulties in the way of any materialistic hypothesis as a foundation of practical science, not to mention the philosophical difficulties encountered at the outset.

There remains but one possibility—the appeal to energy. This method of approach seems very difficult, especially to those who have served an apprenticeship to modern physical science, because the idea of a medium or vehicle of force has become so strongly intrenched in the didactic literature and in the formulæ with which much of the practical work is done. It must be remembered, however, that the fact that a velocipede is equipped with three wheels does not prove that a bicycle may not move faster. If matter is unnecessary as a practical utility, the sooner this conception can be removed the better for the progress of science.

Historically, germs of the energic idea have always existed. It may seem fanciful to discover the nucleus of the dynamic concept in the dawn of philosophy, but in the ἀρχὴ or *Urstoff of* Anaximander we have a ground of energy, which, while not purely dynamic, and developing in dualistic form in antinomies of heat and cold, still indicated a naïve appreciation of energy as real, apart from a material substrate. This method of thought was common till Dalton, with his atomic hypothesis, gave it a long sleep. Malebranche postulated an absolute substance which includes all things and also the *idea* of all things, to resolve the dualism of Cartesian substance. Spinoza, too, denies the possibility of numerous substances, and demands an absolute substance, which is the real ground of all existence and the source of all reality. All expression of this reality is a limitation or negation (*omnis determinatio est negatio*). Matter and spirit are the two forms of self-limitation in which absolute substance appears. These are the attributes in the form of which substance reveals itself. There may, indeed, be many attributes in the substance, but, by the nature of the human mind, we distinguish subjective and objective.

In Spinoza we find the Cartesian dualism between matter and spirit maintained. There is a parallelism, but mind cannot work on matter, nor can matter influence spirit. These two are phases of one reality, so that there is correspondence but no interaction. (It should be observed that this is a much deeper view than that expressed in the current psycho-physical parallelism of psychology, which, as usually formulated, means nothing but the statement of an observed coincidence.)

The reconciliation of these difficulties is to be found in energism, which explains that neither body (matter) nor spirit (soul) exist as independent entities, but both are ways of experiencing the same energy. As Spinoza admits, the distinction between matter and spirit is of our own creation. When I feel a sensation and discriminate my feeling of it from some outside activity, this is a valid discrimination for *me*. The whole chain of activities between the outside source of light and the accommodation activities in my organ, form parts of a segment of activity, which *in itself* requires no explanation beyond the fact of spontaneous *doing*. The things I think about this (objective aspect) and the thinking about it (subjective part) cannot be distinguished as existences (matter and spirit) parallel to each other. Whatever truth they have inheres in the activity producing both.

At the present time, science represents the remarkable and anomalous spectacle of a vast mass of chemical and physical literature permeated and dominated by materialistic-mechanical theories. The entire pedagogic machinery, including text-books and teachers, is adapted to impart a strict construction of matter and energy as the twin realities in the physical universe, while, at the same time, the foremost investigators, and the authors of some of the very texts referred to, have openly or by implication abandoned these postulates.

The student of Ostwald's *General Chemistry,* for example, will find little to prepare him for such views as those presented in his address at Luebeck entitled "The Overcoming of Scientific Materealism."

As this writer observes, there are collected in the idea of matter

numerous elements of sensuous experience, like weight, extension, chemical properties, etc., which are found by experience associated with mass and connected proporionally with it, so that "the physical law of conservation of mass was transformed into the metaphysical axiom of the conservation of matter." "It is important to note that in this extension a number of hypothetical elements have been wrought into what was originally an entirely non-hypothetical notion." The necessary results of this hypothetical matter-hypothesis lead to absurdities, to which we have become so accustomed as hardly to notice them. As Ostwald says, speaking of the assumed persistence of the original substances in compounds: "When we consider, however, that all that we know of any substance is a knowledge of its properties, we see that the assumption that a definite substance remains, although it no longer retains any of its properties, is little removed from nonsense."

Nor is this all, for, having adopted the matter postulate, it is necessary to supplement it by the doctrine of energy. As matter is quiescent and unalterable, it is necessary to connect it with something to correspond with the changes known in experience. This constant cause of motion is energy, and this, like matter, is supposed to be a constant in the sense that its total amount is never increased or destroyed. Ostwald, again, says, respecting the mechanical construction of nature built upon the two above formulæ: "One usually does not observe to what extraordinarily great extent these generally received views are hypothetical not to say metaphysical. On the contrary, it is customary to assume that they express the maximum of exact formulation of actual relations. On the other hand, it must be emphasised that a proof of the consequences following from these theories, that all the non-mechanical processes like heat, light, electricity, and magnetism, are actually mechanical, has not been afforded in a single case."

We have traced in outline the transformations of the optical theory. The others are in no better case.

But if we are deprived of the assistance afforded to imagination by the concept of moving atoms, how are we to conceive of the world of matter and energy at all? Ostwald answers this question very

uncompromisingly: "Thou shalt not make unto thee *any* graven image or likeness. It is not our duty to view the world in a more or less dull or irregular mirror, but rather, so far as the structure of our minds will permit, to view it directly." The function of science is to bring into such definite relations *realities,* i. e., demonstrable and mensurable quantities, that when one is given the other may inevitably be assumed.

This is the energic point of view—not the substitution of one complicated hypothesis for another, but the eliminating of the hypothetical, so far as possible, and the appeal to facts of experience. To the criticism that the concept is empty and lacking in clearness as compared to the material view, we must reply that sensuous perception is a reaction induced by variations in the intensity and form of energy and nothing is gained by postulating media or bearers. Remember that matter is the abstract and energy is the real. The external reality is a reality of relation which the mind makes into *substance,* but substance is not necessarily *matter.* A classical English passage speaks of *faith* as substance.

When asked what advantages are to be expected from a resort to energic methods of notation in dealing with natural phenomena, the energist answers: "First of all, the very important one that by this means we have a natural science of fact and not of hypothesis. We no longer inquire about forces that we cannot demonstrate operating between atoms which we cannot observe, but, in forming judgment of a process, we examine the kind and amount of energy entering and leaving." This method is that proposed by Kirchhoff who wished to supplant explanation of nature by description of nature.

Physics shows that the ratios used in her computations are without exception ratios of different kinds of energy. Aside from the two forms or categories of perception, space and time, energy is the only measure. But space and time are measured by energy alone, for energy forms their only content. The predicate of matter cannot find a mathematical expression in eqations of energy. Only commensurables can be compared.

When physics repudiated force (in the usual sense) and chem-

istry reputiated matter and both cry "back to nature—back to experience," what science is to reap the benefit, or rather is to fill the breach? There can be but one answer. Psychological moments alone remain reliable and trustworthy measures of quantity. In last resort we discover (what has always been known but never realised) that the only energy we really know is that which we ourselves generate. The axiom at the bottom of all science is that the force impinging on my sensorium is commensurate, according to some law, known or unknown, with the reaction within my kinesodic system. In other words, the only real measure is mental reaction thereto—sense of effort or strain. Everything quantitative in science has to be interpreted in terms of effort before it can be recognised in any consciousness. It is customary, e. g., to reduce all measures of physical quantities to scales on some dial, let it be of an electrometer, ammeter, barometer, thermometer, photometer, or the like. The reading of such scales, is in final analysis, reducible to muscle-strain estimates in the eye-muscles, and the graduation of the scales may be reduced to a function of muscle-strain estimates in the hand, etc. It would seem, then, that we really estimate in homo-ergs or man-powers. May it not be possible to reduce all to a standard, say of "psychs"? The suggestion is not so far-fetched as it may seem, but the objection we at first meet is that there is no assurance that a unit of reference that would be true for me would be absolute for all men. A John Smith-erg might not equal a Joe Brown-erg. Expressed scientifically, the neural mechanism of man is so complex and the number of variables is so enormous and its processes so varied that it is difficult to discover a constant for a standard of reference. The resistance offered by the organism to external influences varies. Attention is not a constant, and all mental phenomena are functions of attention. In this dilemma the mind has recourse to an indirection. Being unable to find any single constant, it utilises a ratio. Under the assumption that the variables in perception affect both terms alike, then the result will be the same whenever the ratio affects the mind, no matter what phase attention may be in. This is a process of comparison.

To illustrate crudely, I may not be able to tell how far I travel

by summing up the total effort expended in walking, but I am able to reach an estimate by comparing a constant of effort in walking multiplied by the time employed, with a similar effort multiplied by twice that time. The mind very accurately detects differences when it fails to measure their amount. $(D : te :: D' : 2te) = (D = 2D')$, where e is a constant of effort put forth at any time, i. e., the habitual gait in our illustration. Very little experience shows that both factors, time and effort, vary below the threshold of consciousness and do not vary uniformly. If they varied proportionally and the equation could be written $D : te/x :: D' : 2te/x$, it would still be available but it must be written $D : te/x :: D' : 2te/y$, and cannot be solved. It having proven useless to attempt to construct a constant ratio on the subjective basis only, i. e., entirely on the basis of internal experience, values for x and y, i. e., for the variables in our equation, must be derived from without. The uniformities in experience, such as the succession of day and night and the annual astronomical recurrences, are used and continually corrected, till they can be represented by a contrivance like a clock or metronome. In this way, the internal time estimate becomes definitely linked to external changes. In similar ways, the other term, say, the effort in walking, is linked to external correspondences so that x and y become known in terms of t and e and the ratios t/x and e/y can be used in our construction of the world of experience. At the same time, it must not be forgotten that the ultimate standard is internal unit or constant of effort, without which the entire external mechanism would be valueless.

We have seen that the three categories of experience are time, space, and mode. In these three forms all experience is cast. Time is a necessary form of experience because of psychical limitation; two events cannot co-exist in consciousness. This is a result of the unity or individuality of experience. The psychological equivalent is sequence.

Space is likewise a result of the limitation of experience. Effort implies change. The external equivalent is motion. These two, sequence and motion, are the generators of the extended continuum of experience, which is filled in by the form of experience called

mode. Two modes may be distinguished, identity and difference, or, rather, mode consists in the distinction of difference from identity.

While the mind is incompetent to make quantitative distinctions directly, it has the most remarkable clearness and certainty in dealing with difference. Psychologists have used all their ingenuity to utilise this ability to discriminate differences as a basis for a quantitative psychological science. It would appear that a series could be made after the analogy of differential calculus, in which the several terms should increase by a difference less than any assignable quantity (the discrimination quantity), and that such a series could be compared with a corresponding series of external quantities, thus giving rise to a mathematical relation that should form a quantitative unit for sense perception. Almost the only result, so far, of this effort is expressed in the so-called Weber's law that while the series of excitations increases in arithmetical ratio the corresponding series of excitations must increase by geometrical ratio. And yet even this is found to express only approximately and within narrow and arbitrary limits a relation for which no adequate or constant explanation can be given.

A fundamental criticism of attempts to use the sense of effort as a unit of measure is that two or more things are frequently confused under this head. In the first place, the muscle sense or sense of muscular effort, if we are justified in speaking of such a sense, is a sensation-complex . It is not analoguous with the sense of having originated a voluntary act. Attention, which is involved in all receptive mental acts, involves, among other things, accommodative effects in organs of sense, it may also involve accomodation phenomena in the brain itself.

The inquiry remains: Is there such a thing as effort in consciousness apart from these accommodations? A prevailing psychological interpretation is to the effect that the afferent nerve current passes over into the efferent, according to conditions of structural organisation, and that the issuing into the efferent expression produces, or is accompanied by, a sense of action, or impulse, or initiative, or effort, out of which the sense of having-done-it arises. It is even

customary to speak of the will as arising subsequent to the voluntary act as a consequence of the act. However this may be, if muscular sense is really a sensation, like other sensations, and not a direct feeling of psychical activity or participation, then our supposed quantitative unit reduces to a series of modes. Instead of a simple more or less, we have different impressions which we *interpret* as more or less. The sensation produced by a weight of two pounds is a different sensation from that produced by one pound, not a more of an identical sensation. Evidently, we are on the wrong track somewhere. This raises the general question whether it is possible to use pure modality as a measure of quantity. A light twice as bright as another does not produce a sensation twice as intense nor one in logarithmic series as compared to the series of stimuli. We do recognise identity and change.

Theoretically, it is wrong to seek quantitative measures in the categories of external apprehension, since we are seeking an internal measure. Sensations cannot give this as they are all projected out ward or externalised. Succession is, strictly speaking, all that the internal sense or inner experience can contribute.

Can it be, then, that the formal subjective measure is to be expressed in most general terms by *at,* where *a* is any attribute and *t* is succession or time? Such would seem to be the necessary *a priori* assumption. A test of such an assumption may be found in its applications.

Space, when filled, consists of one, and another, and another, etc. An absolutely uniform field of vision (or of any other experience, if possible,) could not be made to seem extended. This creeping from particular to particular is essentially, on its inward side, temporal, as it becomes on its outward side spatial. All our measures are now reduced to serial terms. When we say that one light is twice as bright as another, or that one star differs from another in glory, we express the results of a complicated system of judgments. If it takes me twice as long to traverse the plowed ground as the meadow with the same constant of effort, I have a measure for effort. Even here the difficulty is at once perceived

that we have no subjective time measure. We may use heart-beats, but even heart-beats are objective to the mind.

Succession and change, in last analysis, must be our subjective contribution to quantitative science, and it is useless to seek more. These forms are filled by experience, and we find our periodicity in external experience. The curious, if not altogether unexpected, result is that the soul itself has neither time nor extension.

After having appealed in vain to psychology for a complete quantitative unit, we are prepared to admit that *quantitative estimation is but one of the ways in which we affirm attribute. Its reality is neither wholly subjective nor wholly objective, but one of the forms of reality resulting from the union of both.*

If we eliminate matter as irrelevant, we have left energy, which reveals itself to us in terms of succession and mode. It produces varied sensations, and these are arranged in sequence. Our ability to recognise identity in mode gives rise to periodicity, and this is the measure of time. Some particular period, say a second, is chosen as such unit.

The negation of succession is co-temporaneity which is possible in connection with diversity of mode, and this is only objectively possible in terms of space. Two identical points have no spatial relations. All space relations are possible only upon the assumption or condition of co-temporaneity. The following psychological formulæ may be useful:

1. Sequence with identity produces periodicity = time.

2. Co-temporaneity (o × sequence) with diversity produces space.

3. Sequence with diversity produces change.

4. Co-temporaneity with identity produces intensity.

These abstractions require elaboration.

I. (Seq. × Iden. = T.) I experience a series of sensations, tic, tac; tic, tac; tic, tac; etc. One follows another in temporal sequence. But I detect a rhythm or identity. Where it not for the rhythm I should get no time measure. Thus I have succession and identity as necessary elements of temporal mensuration.

2. (o × Seq. × Diver. = S). On the other hand, in space re-

lations as such, sequence is impossible. Even when we conceive of a moving point generating a line, etc., it is always implied that at the same time the original point and all other points in the line co-exist in time and are considered together. The diversity of each point in space is represented by the locus formula, but the origin represents a constant point of reference, and time is excluded. It may be replied that time is simply ignored and diversity is all that is needed to produce a spatial measure. This is not true, for co-temporaneity is a real concept of form, though impossible in inner experience. Co-existence and diversity are possible only under space conditions. This distribution of mode and identity of time form the psychological data of space.

3. (Seq. $\times$ Diver. $=$ C.) Sequence and diversity are, in like manner, the psychological moments of change. If the sensation or sense datum be not co-temporaneous, or thought in one time with its predecessor, it has taken the place of that predecessor and there has been change.

4. (Cotem. $\times$ Iden. $=$ Int.) But, on the other hand, if the mode has not changed, but is thought into the same time, we get the concept of intensity or more of the same, or quantity. This predicate of intensity is not given in experience, but the same may be said of the others. Time is not a direct element in experience, though sequence is. Space is not a primary idea but is generated from co-existing diversities. Change is other than diversity. It is only when the temporal element is added to difference that the category of change is formed.

We have given, therefore, these fundamental derived psychic data of the second order not as subjective predicates, but as the first results of reaction between subjective and objective. If our psychological analysis has been correct, by means of these four moments it should be possible to construe all phenomena possible to experience. It may be left to mathematical physics to make the applications of these principles and the necessary substitutions in the formulæ in general use.

In conclusion, we may refer to the metaphysical results which transform the physical doctrine of energism into the psycho-philo-

sophical dogma of dynamic monism. In a little book published anonymously by Kegan Paul, Trench, Trübner & Co., London, in 1898, entitled *The Doctrine of Energy*, the author offers suggestions which deserve a wide reading. "The study of physics *can* be carried on practically as a study of phenomena—of heat, colors, sounds, forces, etc., all of which are kinds of phenomena—without the expression of any formulated opinion as to their relation with reality." "But science has been reluctant to recognise that it is now entitled to dispense with the postulation of matter. The theory, as announced by the leading men of science, has, therefore, been to the effect that there exist in the physical universe *two real things*, matter and energy, in place of one only, as commonly supposed for so long. We have elsewhere attempted to show that such a statement of scientific theory is erroneous and redundant; that science is not necessitated to postulate *two* such entities; but the postulation of energy supplies all her requirements." "Our view, therefore, is that the conception of materiality and of real matter can, in the way just indicated, be in all cases analysed into, and derived from the conception of energy; and that science, if consistent, cannot postulate the reality of matter as well. Potential energy adequately supplies the conception of a real substratum of which phenomena are the manifestations."

To the question: "How do I get beyond my presentiment? How pass from ideality to existence?" the answer is, "I never could have got beyond it or got any suggestion of the reality had I been related to my presentiment as a passive and percipient subject." I am in relation with the energic system not merely or primarily as an intelligent percipient of the transformations proceeding in it at a particular point, but also as a will initiative, to some extent, of such transmutations and capable of influencing and directing the physical process." "In my activity there is thus suggested to me a source of phenomena lying beyond the phenomena themselves." "My most incessant mental act is that by which, on analogy of my own active experience, I refer all phenomena to the underlying energic system."

We cannot go into the author's treatment of causation as a

derivative from the self-consciousness of initiative, which is then objectivised and recognised as one with the source of all action—energy. Enough has been said to indicate a close connection with the position taken by Schopenhauer in the *Fourfold Root*. "What we think under the conception, *matter*, is the residue which remains over after bodies have been divested of their shape and of all their specific qualities; a residue which, precisely on that account, must be identical in all bodies. Now, these shapes and qualities, which have been abstracted by us, are nothing but the peculiar, specially defined way in which these bodies act, which constitutes precisely their difference. If, therefore, we leave these shapes and qualities out of consideration, there remains nothing but mere activity in general, pure action as such, causality itself. Matter is throughout pure causality, its essence is action in general."

That these views will be slow in finding acceptance among the rank and file of chemists may be gathered from remarks in F. W. Clarke's "Wilde Lecture" before the Manchester Philosophical Society, May, 1903.

"When we say that matter, *as we know it*,[5] behaves as if made up of very small discrete particles, we do not lose ourselves in metaphysics, and we have a definite conception which can be applied to the correlation of evidence and the solution of problems. Objections count for nothing against it until something better is offered in its stead, a condition which the critics of the atomic theory have so far failed to fulfil."

This illustrates how, for each of us, his own particular brand of metaphysics seems harmless or not to be metaphysics at all, for this is exactly the contention, that the material hypothesis is metaphysical and has added nothing to the definiteness of our conceptions of physical phenomena, neither can it legitimately be utilised for the solution of problems. The abacus has long since been abolished from our schools, is it still necessary to our physicists, must our chemists still continue to count on their fingers?[6]

C. L. HERRICK.

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[5] Italics mine.

[6] The question might be asked, (in fact, it has been asked): "How is it

possible to get the resistance or limitation necessary for the objects of our experience out of pure energy?" "Is the element of tension and opposition in your very conception of energy?"

The reply to this should be based upon an examination of the nature of the energy concept more detailed than is germain to our present purpose. The difficulty is, probably, like nearly all philosophical perplexities, a result of our unhappy logical faculty for splitting things that ought not to be divided. We may undoubtedly think of the *word,* "doing," apart from the expression, "doing of something," but it is to be doubted whether we can think of *pure* energy at all. We think by "affirming attribute." It is still more energetically to be insisted that no real severance of the doing from the thing done is permissible. It is the old matter fallacy or the cause-effect fallacy in a new guise. If energy is to be set up in the place of matter as a power behind the throne, let us alone and we will return to our idols.

Viewed from a physical point of view, given no resistance to action, there is no energy. If we mean anything by energy, it must be valid in that it is acting. If the sum-total of universal energy were in like phase, it would be the same as if there were no energy so far as making a universe is concerned. Herbert Spencer has not lived in vain. Pure being is the same as non-being. We have had our Hegel. A non-acting deity would not even potentially be a God.

Practically, energy is called into and remains in existence only under condition of resistance. Resistance is varied and gives rise to *mode* in energy. In an earlier paper the writer defined creation as the self-limitation of creative power. This is not subject to further analysis. Having no experience with universal or infinite modes of being, we do not expect to understand what we must nevertheless postulate. If this view is open to the taunt that we take out no more than we put in and so are no better than prestidigitators, our reply is ready. If other people take out of their logic more than they put in, they lay themselves open to the charge of dishonesty. The taking out of more than is put in is called in logic "fallacy."

DID THE MONKS PRESERVE THE LATIN CLASSICS?

SINCE the civilized world has held the classics in honor, the admirers of the cell and cloister have claimed that, throughout the Dark Ages, the monks loved and studied the classics, and, by copying, preserved them for posterity.

This claim has been pertinaciously urged; and as it has been admitted by certain writers of good repute and great complaisance, there is danger that it will become one of the conventional statements in history.

Believing as I do, that the admission has been made without due examination and in gross misconception of the spirit and history of Mediæval times, and particularly of the monastic system prior to the year 1200, I ask your attention to the opposite view of this subject. I shall treat it as one purely historical, keeping in view nothing but the Latin classics, and how they were treated by the monks of Western Europe up to the end of the twelfth century.

EXTENT AND AMOUNT OF ROMAN LITERATURE.

While the modern public is familiar with the multiplication of books by the printing press, it knows little or nothing of the ease and rapidity with which the "tachygraphs," the swift penmen of Rome, threw off their manuscripts. It is difficult for us to conceive that there were in Rome large numbers of professional literary men, great libraries, public and private, numerous persons engaged in book-selling as a regular business and having a trade with all the provinces of the Roman Empire and with booksellers

in all their cities and towns; that there were in the Roman Empire more copyists probably than there are printers in the United States; that the ancients made better ink than we do; and that their parchment volumes were more durable than our paper books. And we, it may be, admit nothing in favor of the Romans, quite so reluctantly as that, in the matter of books and literature, they were in some respects, barring the difference between types and penmanship, quite equal to the Americans of the twentieth century.

The Public Libraries of Rome, about the year 100, were magnificent. The *Octavian* was built of marble; its floors were laid in mosaic work; its ceilings were frescoed in gold; and the walls were decorated with glass and ivory. A hundred statues stood there upon pedestals. In it there were more than one hundred thousand volumes neatly stored in cases of cedar and ebony. Catalogues, with references to each volume, by case and number, hung upon the walls and pillars. There were tables and seats for the students; and assistant librarians were there to find any volume required.

The *Palatine Library* rivalled the Octavian; and the *Ulpian,* newly erected by the Emperor, was the most magnificent of the three. In these libraries were collected the literary treasures of the Roman Empire, and in them were daily gathered readers, students, writers and authors.

There were also many private libraries: Every lawyer, author, rich man and patrician had one. Among the best known collections in the literature of the age were those which had been begun by Paulus Æmilius, Sulla, Lucullus, Varro, and Cicero. Some of these were large and were kept in buildings which had been erected especially for them. There were many others. This we know from numerous indications in the manners and customs of the times, and from hints in the books which are still extant. These private libraries existed not only in Rome, but in the towns and cities of the provinces, and, doubtless, in the villas of rich men. In the ruins of Herculaneum one was found. It contained eighteen hundred volumes, sadly charred by the molten lava of many volcanic

eruptions; but the art of the chemist restored them enough to show that they were all on the same subject, the Epicurean philosophy. If the Roman literature contained eighteen hundred books on that one subject, how many must it have contained in all?

There were schools in all parts of the provinces; and these must have created a demand for books. Some of these were famous,—we would call them colleges,—e. g., those at Carthage, Marseilles, Lyons and Narbonne. There were schools of rhetoric at Rhodes and Miletus; of philosophy, at Athens; and of law, at Beyroot, on the coast of Syria; and there was a renowned University, at Alexandria, in Egypt. Each of these schools gave employment to copyists.

Some of the swift writers worked alone; others were employed, in large numbers, by capitalists. Atticus, the friend of Cicero, is said to have employed two hundred, most of them slaves. A description of the *Scriptorium* or writing room has been handed down to us. The room was large and furnished with desks for the copyists. The reader sat on a raised platform in the front and center; he read slowly, and the copyists wrote. Their work was carefully revised. When approved, the long strip, on which the writing was done, was rolled upon a stick, tied up with ribbon or string, and labeled. It was then ready for sale.

The Roman booksellers often published what is now called an *edition de luxe.* The finest of these were written in golden letters on purple vellum and embellished with portraits of emperors, authors and other celebrities. The elaborate initial letters of books and chapters were the models of the wonderful decorative illumination of missals and other precious books of the Middle Ages.

The Romans knew nothing of movable types and printing presses. Their method of producing by single copies was not so favorable as ours to the publication of daily newspapers. They managed, however, to get out two, at Rome. They were called the *Acta Diurna,* a name from which our word "Journal" is derived. One of them was the official organ of the government; and the other was devoted to social, political and military news. The number of copies issued is unknown.

The Roman authors had a custom similar to our reunions to hear an essay followed by a discussion of it. When an author finished a work, he invited other authors and the booksellers to hear and criticize it.

It is a great pity that there is not extant a contemporary bibliography of Latin literature. The best help in that regard are the frequent allusions to books in the works preserved to us. The elder Pliny, in his thirty-seven books on Natural History, is said to have quoted by name from several hundred authors. The younger Pliny claims that, in preparing his history, he consulted at least a thousand writers of chronicles, annals, history and biography. The elder Pliny and Cato each published a Cyclopædia. Some authors were prolific; Varro is said to have published more books than Alexander Dumas.

To the student of history, the above facts will suffice to freshen his conceptions of the complexity, variety, universality and wealth of the expression in literature of the mind of ancient Rome.

PERISHED.

Of the innumerable Latin works of the classic period of Rome, there remain, in round numbers, a hundred: I count the survivors, mutilated and whole; and of the immense army of more ancient times, only a company answers to roll-call

About the year 740, Pepin the Short, of France, wrote to Pope Paul I., asking him as a favor to send to Paris all the books he could find at Rome. Paul caused diligent search to be made in the papal palace and the city. The result was, he sent to Pepin five books: an antiphonal, or elementary book of church music; a responsal; and three short treatises: one on grammar, one on orthography and one on geometry.

Between the years 340 and 740, the classics had almost disappeared.

THE MONASTIC SPIRIT.

In those four centuries, the monks were the most striking feature in the Church of Egypt and of Europe. Who were they?

The answer to this is best gleaned from the lives of the hermit fathers and the histories of the monasteries. Rev. Charles Kingsley, in his book on this subject, gives many of the facts. He says:

"Eight hundred years before St. Anthony fled into the desert, that young Hindoo rajah, whom men call Buddha now, had fled into the forest, leaving wives and kingdom, to find rest for his soul. He denounced caste; he preached poverty, asceticism, self-annihilation. He founded a religion * * * democratic and ascetic, with its convents, saint-worship, pilgrimages, miraculous relics, rosaries and much more which strangely anticipates the monastic religion."

This asceticism of the Orient began to infect Egyptian Christianity, in the second century; and in a few generations the mountains and deserts of Egypt were full of Christian men who had fled out of the sinful, dying world, to attain everlasting life. Celibacy, poverty, unconditional obedience to superiors, continued meditation upon the vanity of the world, the sinfulness of the flesh, the glories of heaven and the horrors of hell, were their vows.

Athanasius wrote the life of St. Anthony, the model of the hermits. That saint ate nothing but bread and salt and drank nothing but water. He lived in the desert and in a tomb, drove devils from him in the shape of a black child, was beaten once and again by demons, wore a garment of the skin of a wild beast, which he never changed, and never used water except for drinking. He had been well brought up and educated; but his biographer notes that, "for the future, his memory served him instead of books."

St. Jerome wrote the life of the hermit saint, Paul, who lived in a cavern where "he spent his life in prayer and solitude while the palm trees gave him food and clothes." St. Jerome adds: "I call Jesus and his holy angels to witness that I have seen monks, one of whom, shut up for thirty years, lived on barley bread and muddy water; another in an old cistern * * * was kept alive on five figs each day."

A philosopher asked Anthony, "How art thou content, father, since thou hast not the comfort of books?" Quoth Anthony, "My

book is the nature of created things; in it, when I choose, I can read the words of God."

St. Hilarion was the father of monachism in Palestine. His life was written by St. Jerome, who died a monk in Bethlehem. From his sixteenth to his twentieth year, he lived in a tiny cabin woven of rush and sedge; after that in a cell, four feet wide and too low for him to stand up straight in. He lay "on the bare ground and a layer of rushes, never washing the sack in which he was clothed, and saying that it was superfluous to seek for cleanliness in hair cloth. Nor did he change his tunic until the first was utterly in rags. He knew the scriptures by heart and recited them after his prayers and psalms." His only book when eighty years old, seems to have been a copy of the gospels, which he had made for his own use when young.

"Serapion, the Sindonite, was so called, because he wore nothing but a sindon or linen shirt. Though he could not read, he could say all the scriptures by heart."

Arsenius died, a monk, at ninety-five years of age, having wept in his cell for forty-five years. By the standard of his times, he had been learned in his youth, but gave up books for the monastery and desert.

Marana and Cyra were two women saints who spent forty-two years in a roofless cottage, "shrouded from head to foot in long veils," * * * "and underneath their veils, burdened on every limb, poor wretches, with such a load of iron chains and rings that a strong man," Bishop Theodoret says, "could not have stood under the weight." They had fasted at times for many days together. The Bishop comments upon their holiness with rapturous admiration.

St. Simeon used to fast for forty days together. He lived for many years on the top of a high peak. The account of the visit of his mother to him is instructive. She begged and implored him to come out of the tower in which he was walled up, or to admit her, but he would do neither. He heard her voice and spoke to her, refusing to see her. The biographer says: "But she began to say:

"By Christ who formed thee, if there is a probability of seeing thee who hast been so long a stranger to me, let me see thee; or if not, let me only hear thy voice and die at once, for thy father is dead in sorrow because of thee. And now, do not destroy me for very bitterness, my son."

Saying this, for sorrow and weeping, she fell asleep; for during three days and three nights, she had not ceased entreating him. Then the blessed Simeon prayed the Lord for her, and she forthwith gave up the ghost."

Of St. Godric we are told, he was no scholar, but had gradually learned by heart the Psalter. He was an Englishman, but as great an ascetic as his continental brethren.

It is evident that the monks and hermits were not literary or scientific men. They placed the narrowest interpretation on those New Testament texts which speak of the "wisdom of this world" as "foolishness with God," and which caution believers to "avoid profane and vain babblings and oppositions of science falsely so called."

When Constantine, about 325, made Christianity the State religion, asceticism was the highest ideal of the instituted church. Eusebius, one of his bishops, ascribed the neglect of learning among Christians "to contempt of such useless labor," saying they preferred "turning their souls to the exercise of better things." It was held that the Bible contained all it is necessary for man to know, and that science is sufficiently revealed therein.

"Is it possible," says Lactantius, another father of the Church of the same period, "that man can be so absurd as to believe that the crops and the trees on the other side of the earth hang downwards and that men have their feet higher than their heads?"

The ink was hardly dry on Constantine's proclamation of Christianity as the religion of the Empire, when a bareheaded and black gowned priest started on foot from Constantinople for Athens, bearing an edict which closed up at once all the government schools of science and philosophy and abolished the salaries theretofore paid the professors by the Emperor.

To be a graduate of one of these schools was enough to exclude a man from all employment under the Christian government.

Libanius, a celebrated professor of that day, complains that the Imperial Court looked with an evil eye on the schools. "Men of education," he said, "were driven away and ignorant upstarts promoted to places of honor. Graduates in philosophy and rhetoric found all the avenues to wealth and honor closed to them and were glad to get a place as Emperor's messenger or to wear the livery of household servants."

Under other edicts, the pagan temples in many parts of the Empire were seized and turned into churches or levelled with the ground. The fine libraries attached to them were destroyed; their beautiful statues were overthrown, mutilated and, oftentimes, burned for lime.

About 390, Euriapus, a learned pagan of Lydia, wrote: "Thus, these warlike and courageous champions, after causing general ruin, and stretching forth their hands, not stained with blood indeed, but befouled with avarice, boasted that they had overcome the gods, and, taking credit for their impiety and sacrilege, let loose against the holy places the so-called monks, who were men indeed in outward shape, but of swinish life and manners, who openly committed abominations without number. * * * For any one who liked to put a black coat upon his back, and a sour look upon his face, could lord it like a tyrant."

Libantius, a learned professor of the same century, who had retired from Constantinople to Antioch, thus vented his indignation:

"This black-coated gentry who are more ravenous than elephants * * * in defiance of existing laws, hurry to attack the temples, some with staves and stones and steel, others even with fisticuffs and kicks. The temples fall an easy prey; the roofs are stripped, the walls hurled down, the statues dragged away, the altars overthrown. The priests must hold their peace or die. When one is ruined they hurry to a second or a third and pile fresh trophies in defiance of the law. Such acts of violence occur in the cities, but far more in the country."

For more than sixty years, after the decree of Constantine, the Serapion of Alexandria, in Egypt, had escaped destruction at the hands of the monks. This was due to several causes. It was

an old institution and the pride of the city on account of its magnificent architecture. It was visible over the Mediterranean as far as the eye could reach, being placed on an eminence and towering high in the air. Its rows of gigantic columns were of the finest marble in the world. Long and broad marble steps led up to its front and the equipages of rich citizens could be driven up a beautiful inclined plane in the rear to the level of the temple. It was not only a temple but a university and library. The splendors of the religious ceremonies of the Greeks could be seen here. The university, with its numerous professors and students, was the same in which Euclid had produced his geometry, and the Egyptians had perfected the astronomy of the Ptolemaic system. It was not so prosperous as it had been, but young men still came to it from all parts of the civilized world.

The library, too, was one of the finest. Not so large as the one collected by the Ptolemies before the Christian era and destroyed in the Bruchium, by fire, at the time of Cæsar's siege; but it contained the collection of the King of Pergamos, which had been presented to Cleopatra by Mark Antony, and the additions of three centuries.

It offended the pious Theophilus, the Christian Bishop of Alexandria, that the Serapion, with its philosophy of Aristotle and Plato, and its Greek ceremonial of worship should divert the attention of Alexandria from Christianity. He petitioned the Emperor at Constantinople for leave to destroy it, and his petition was granted.

On a spring morning in the year 389, of the Christian era, the military formed a grand cordon around the Serapion. Then, the Bishop and his train in the background, bareheaded and barefooted monks filed slowly within the Military. The population of the city, the professors and students looked on; the edict was read; the Bishop applied the torch; the building was fired in a hundred places by the monks; and the black smoke carried to the sky the best product of the Greek civilisation of nine centuries. When night came, all that remained of the famous libray of Alexandria

was a mass of cinders; and a band of hooded monks praised God over the ruins!

This signal triumph over paganism greatly strengthened the power and increased the number of ascetics. Many persons abandoned the ordinary pursuits of life and fled to the desert monasteries. On those interminable expanses of white sand, where there were no trees with waving foliage, no rivulets with crystal waters, no birds, no flowers, nothing but sky and desolate wastes, it was easier to think of, and hope for, the future life. On the sands of Nitria, there arose twenty monasteries; on their stone floors barefooted monks chanted prayers every hour in the day; in their cheerless cells ascetics fasted, watched and scourged themselves with bloody thongs.

In the twenty-six years that followed the burning of the Serapion, the University of Alexandria began to re-establish itself. Some of the professors reopened their courses; students, who had been scattered among the schools of Asia Minor and Greece, came again in small numbers to Alexandria. The Bruchium and Serapion had been destroyed; the Museum was now the nucleus of the University. How many books there were, what apparatus there was, is not known. Everything that was done for Greek philosophy, was done in the presence of a jealous Christian patriarch whose authority rivalled that of the Roman Governor.

In the year 415, of the Christian era, the most distinguished professor in Alexandria was a woman. Hypatia was the daughter of a learned mathematician and professor. In her youth she had been sent away to school at Athens, because of the destruction of the University at Alexandria. Her life had been spent in study, in the best schools and among learned men. She was a mathematician and philosopher. Heaven had endowed her with the gift of touching the human soul. Her presence was magnetic and her voice unsealed the founts of human feeling. She had the power which in modern times has been wielded by Mrs. Siddons, Rachel, Angelina Grimke, and other women. Her renown was coextensive with the Roman empire. Her lectures on Neo-Platonism attracted the best intellects not only of Egypt but of other countries.

At the time Cyril, a monk, was Bishop of Alexandria. Full of the intolerant bigotry of his order, he determined that Hypatia should be silenced and the Museum destroyed.

At his summons the Nitrian monasteries poured forth their hordes. Across the sandy plains of north Egypt, thousands of black-gowned and barefooted men with shaved heads,—men gaunt and pale with fastings,—made their way, chanting hymns, to Alexandria.

On their arrival they were duly organized and instructed by the Bishop's agents. Next morning they waylaid Hypatia on the street by which she was wont to drive to her lecture room. They dragged her from her carriage, smote her to the earth with fists and clubs, tore off her garments and hurried her, bleeding and naked, through the streets to the cathedral, then up its marble steps and through its lofty nave to the altar.

There she turned and stretched out her hands as if she would speak; but in all that monkish crowd she met no glance of human pity. Her voice was lost in the cries and shouts of that murderous mob. Then her heart failed her, and sinking on her knees before the crucifix, she prayed Christ to touch with pity the hearts of those fanatics. But, as she prayed, the monk Peter dashed out her brains with a club. In a moment she was hacked and torn to pieces, and the frenzied monks went in procession through the streets, bearing upon a spear a woman's head, whose long, fair tresses were flecked with blood! Her death has been dramatically described by Charles Kingsley.

After the murder the Museum was sacked and pillaged, its pagan works destroyed and its professors silenced.

Whether the University of Alexandria recovered from this blow, history does not tell. Nor, whether a library was again collected there. This is not probable, for the patriarch was adverse and had great power; the Roman governors took little interest in literature or learning; and the public revenues were needed by the Emperor. A few books probably were gathered by professors and teachers; but when the Persians conquered Egypt in 616, there is no sufficient evidence that there was a library at Alexandria; and it

is improbable that there was one there in 630, when the Moslems became the conquerors of the city.

What was done in Egypt was done elsewhere in the Eastern Empire. Justinian, a Christian Emperor, gave the finishing blow to the schools of philosophy and science, at Athens, by confiscating their private endowments and private property and abolishing the salaries of the teachers. Every school not under influence distinctively ecclesiastical was ostracised as pagan.

One of the early popes, Gregory I., is said to have collected all the ancient classics he could find at Rome and to have made a bonfire of them! This, in the Dark Ages was greatly to his credit. In these latter days, however, it has been denied by some papistical writers.

It was not long after Gregory, that the fury of the Iconoclasts broke out afresh. About the year 726, under the Emperor Leo, the Isaurian, it howled like a tempest over the Christian world. The pictures of Christ and the saints which had been placed in some of the churches were torn down and trampled under foot; the statues of Isis and Osiris which had been adopted as those of the Virgin Mary and child and left in the churches, and the rude statues of the saints, which were found here and there, were thrown from their pedestals. A savage war of extermination was waged against the statues of pagan gods which had survived the bigotry of several centuries. It was "impious" to carve in stone such gods as Apollo, Hercules, Mars and Jupiter, and such goddesses as Diana, Minerva and Venus. Most of these statues were wholly destroyed; many of them burned into lime. The marble statue of Jesus, erected by Alexander Severus, in the third century, was demolished. Some statues escaped with mutilation. The frightened owners of others, wishing to save them for times more appreciative of art, buried them deep under the earth or sunk them in streams. It is only a few years since a statue of a pagan god was fished up from the bottom of the Tiber, where it had probably lain for 1200 years. When the mud and shells were scraped off, it was found to be not much the worse for its long concealment.

When the tempest of iconoclasm burst forth, it is probable that

but few of the classics were in private hands; for, during several centuries, it had been a dangerous thing for any one to possess them. The Inquisition in matters of faith had a short way with men suspected of worshipping Jupiter; but a number of public libraries were destroyed and among them, one at Constantinople, containing 120,000 volumes. This was the Imperial library, and its destruction was, doubtless, owing to the hatred for all learning not purely religious. It was a sacrifice made by the Emperor to the bigotry of the monks.

This same spirit of hostility to human learning is shown in the acts of the Crusaders. They destroyed the libraries which had been again collected at Constantinople; and, in 1109, made a campaign against Tripoli, chiefly for the purpose of destroying the magnificent Saracen library at that place. It is said to have been larger and finer than the one at Alexandria ever was.

It is a matter of history that the Saracens had seventy large public libraries in Spain, containing altogether more than 400,000 volumes. Two of them, those at Cordova and Granada, were attached to the Moorish universities at those places. The catalogue of one of them is said to have filled forty volumes. All these libraries were nevertheless destroyed by the Roman Catholic Spaniards, who regarded them as the literature of Satan.

But why multiply historical instances? It would require a volume to mention them all. The "healthy literature" of the monks consisted of homilies, lessons, missals, prayers, response books, the writings of the fathers and a little grammar, rhetoric and history, chiefly ecclesiastical. It was not thought consistent with a pious life to study the classics.

Alcuin, a learned man, became a monk in the middle of the eighth century. His monkish biographer says of him:

> "This man of God had, when he was young, read the books of the ancient philosophers and the lies of Virgil, which he did not wish now to hear or desire that his disciples should read."

Alcuin rebuked one of his monks for reading Virgil and spoke of the danger of being "polluted with Virgil's language."

Odo, Bishop of Clugni, read one day in Virgil, but dreaming of snakes the same night, he accepted the divine warning, renounced Virgil and his pomps and ever afterwards sought his spiritual and mental nourishment in the Bible.

Peter Damian (988-1072) speaks of the "vanities of earthly science."

Honorius (1120) says:

"It grieves me when I consider the number of persons who, having lost their senses, are not ashamed to give their utmost labor to the investigation of the abominable figments of poets,"

He speaks of Hector, Plato, Virgil and Ovid who "are gnashing their teeth in the prison of the infernal Babylon under the cruel tyranny of Pluto."

Abelard (1142) asks:

"Why, then, do not the bishops and doctors of the Christian religion expel from the City of God those poets whom Plato forbade to enter into his kingdom of the world?"

Peter of Blois, Archbishop of London (1130—1200) upbraided a monk for studying "the foolish old fables of Hercules and Jove" and the lies and philosophy of the pagan authors.

In the opinion of Pope Gregory the Great it was "shameful" that a priest should study the classics.

From the year 325 to the year 1000 of our era all æsthetic sense seems to have fled from Western Europe. During that long period, with the exception of a moderately good book by Bœthius, a statesman, there was not a single book produced whose literary form makes it valuable; not a single painting which any one cared to preserve; not a single statue which the world has not gladly allowed to perish. The best books were "The Fathers," those wonders of prolixity, the best paintings resembled the figures upon cheap China ware; and the best statues caricatured the anatomical proportions of the human form. The books prove that their authors had never studied the classics; the statues, that the artists had never studied ancient sculpture.

I will now briefly notice a few of the objections to the theory of this essay.

First: *That the monks were good classical scholars; hence, they were inclined to preserve the classics.*

This is not true of the monks of any age; it is deplorably false of those who lived in mediæval times. It is believed that between the beginning of Christian monasticism and the year 1100 there was not a single scholar of fame who had been a monk from his youth. All of the famous writers who were monks were men who had been in civil office; or had been educated in the secular schools; or had practiced law or medicine; or taught rhetoric or oratory. To this class belong Augustine, Jerome, Tertullian, Prudentius and Cyprian. This was the case, too, in later times; Gilbert A. Becket and Richard de Bury had been Chancellors of England; Peter of Blois had studied law at Paris and Bologna; Thomas, Abbot of Evesham, had been a lawyer, then Professor at Oxford and Exeter; all these men were of middle or old age when they went into the church and at once took high honors. An abbacy or priory was then the stepping stone to a bishopric. After they became churchmen most of them denounced the classics as pagan. Such men as Wycliffe and Roger Bacon owed no part of their education to the monasteries.

Though the churchmen generally knew a little Latin, chiefly that of the ceremonial, they certainly knew no Greek before Boccaccio's time. About 1350 that poet could not find a copy of the Iliad and Odyssey in Italy and was obliged to send to Athens for it. It was in 1453, a little more than a hundred years after that, when the capture of Constantinople by the Saracens sent hundreds of educated Greeks through western Europe and made the study of Greek more common among the learned. But this was after the invention of printing.

It is doing no injustice to the monks brought up in the monasteries, to say that of the hundreds of thousands in their orders during the Middle Ages there were scarcely half a dozen who are reputed now to have been scholars. King Alfred said that, during his reign, there was hardly a monk from the Thames to the Channel who could go through the church service correctly. Robertson, the Scotch historian, gives many illustrations of their dense ignorance; and so does Hallam. The few exceptions were

such men as Theodore of Tarsus and the venerable Bede. Theodore had been educated in the schools of Asia Minor and brought with him to England a good library of Latin and Greek books, which he presented to his monastery. Bede was Theodore's pupil and had the advantage of his library. His learning would not pass muster now-a-days.

We need no clearer proof of the character of the literature cultivated by the mediæval monks than the list of books which each priest was then expected to own. These were a psalter, a book of epistles, gospels, and hymns, a missal, a manual, a Gerim, a passional, a penitential and a lectionary. With these his library was complete; and he was a fortunate man who had them all.

His light reading consisted of homilies, prayers, the works of the fathers and the legends of the saints,—many of which, it must be admitted, will compare for imagination with the Arabian Nights Entertainments.

Second: *But it is objected that there were schools attached to the monasteries, and that the monks must have taught the classics.*

It is true that to many of the monasteries schools were attached; but these were of the kind now called parochial and were used chiefly to train the children in the church creed and services. They were far inferior to the secular schools, of which there were many. From the biographies of illustrious men we learn that they were rarely educated at monasteries. For instance Lanfranc was taught at Pavia, Bologna and Avranche and established a famous school at Bec. He became a monk late in life and Archbishop, but his learning was not due to monkish teachers.

Third: *A third objection is, that, in each monastery, there was a scriptorium, or copying room, in which the monks regularly copied the classics.*

Neither of these assertions is accurate; and the second is untrue in regard to the centuries preceding the twelfth.

In the last edition of the *Encyclopedia Britannica*, there are given, under the title "Abbey," thirteen ground plans of representa-

tive monasteries. These show every part of the building down to the smallest offices and out-houses; these are as follows:

1. Santa Laura, Mount Athos.	
2. Coptic Monastery	
3. St. Mary's Abbey, at York.	Benedictine.
4. Clugny.	
5. Clairvaux, No. 1.	Cistercian.
6. Clairvaux, No. 2.	
7. Citeaux.	
8. Kirkstall Abbey, Yorkshire.	
9. Fountains Abbey, Yorkshire.	
10. St. Augustine's Abbey, Bristol,	Benedictine.
11. Carthusian Monastery, at Clermont.	
12. Carthusian Cell, at Clermont.	

The only one which shows a *scriptorium* is St. Gall, a Benedictine monastery, erected about 820. The room devoted to the purpose of copying adjoins the transept and is no longer than the sacristy and vestry. The St. Gall monks had more than they could do to copy the books used by the priests in church service.

The clear inference from these facts is that, while in one out of many monasteries, copying of some kind was systematically done, it was not done in most of them, unless by individual monks in their private cells. At St. Gall it was probably done under the supervision of the Abbot and confined to religious books; in the others copying of the same kind was done occasionally, and no doubt, by monks, who excelled in penmanship.

Of the thirteen monasteries named only three are marked as having "libraries," a fact extremely significant as to the want of appreciation of literature at the time the monasteries were built.

If the monks had copied the classics, their ardent advocate, Mr. Merryweather, would have found the proofs of it and printed them in his curious book, *Bibliomania,* which is devoted chiefly to a vindication of their literary character. He mentions all the monkish copyists known and, whenever he can, every classic copied by any of them; but he fails to produce a single instance of such copying between the foundation of the first monastery and the year 1178. We have to thank him for mentioning numerous donations to monas-

teries of private libraries containing classics. There is no proof, however, that the classics so presented had been copied by monks; and the donations are subsequent to the tenth century.

The Benedictine order was established about the year 529; and it is to its practised penmen that the Church of the Middle Ages looked for copies of the Latin Fathers, homilies, prayers, missals, offices, responsals, antephonals, saints' lives, legends and other religious books. But it is not proved that those pious men copied the classical works to any great extent, at any time, or at all prior to the twelfth century. About the year 1178, one of their monks, a famous penman and illuminator, copied the works of Terence, Suetonius, Claudian and Bœthius. This is the earliest case I have been able to find, and it stands alone in the twelfth century.

The reputation for learning enjoyed by the Benedictine order is due to its early cultivation of religious literature, and to its publication, since the year 1600, of histories and works of general and scientific information. Their earliest historical work, a chronicle of their own order, was not published until 1609. But this was 800 years after the dawn of Latin classical learning, 600 years after such learning was common among literary men; and 156 years after the capture of Constantinople and the exodus of learned Greeks from Eastern to Western Europe. Their earliest work of a purely literary character was not published until the eighteenth century.

Fourth: *A fourth objection is that most of the extant manuscripts of Latin classics were found in monasteries.*

Some of them were; it is not proved that most of them were; and surely the manuscripts of the Greek classics were not. The fact that the manuscripts of the Latin classics which were found in monasteries were not found in the libraries of those institutions shows that they were not held in honor by the monks. They were found in cellar pits, vaults, dark holes, dirty passages, dry wells, old towers, in many a den and dungeon. All the manuscript hunters, from Petrarch and Boccaccio in the fourteenth century to Bracciolini in the fifteenth, give the same account of the places where these

valuable relics were found. They had been acquired probably for the parchment they were written on, not for the works themselves. In our century similar facts are reported:

Lord Prudhoe who visited a Nitrian monastery in 1828 says that he found a pile of manuscripts in a vault into which they had been tumbled through a trap-door. They were covered deep with dust and had been lying there apparently for centuries.

Robert Curzon, a member of Parliament, visited one of the Egyptian monasteries in 1833. Going into the chapel at time of service, he saw that each barefooted monk stood upon a folio manuscript which kept him from the cold stone floor. On further search he found a vault full of old manuscripts in all stages of decay.

Tischendorff, the German manuscript hunter, gives a still more graphic account of the neglect of manuscripts by the monks.

The question naturally occurs:

> If the monks did not copy the classics, how are we to account for the copies found in the libraries of the monasteries?

In the monastery chronicles we find frequent mention of gifts and bequests to them of libraries by civilians. A large number of these donations are mentioned by Merryweather in his curious book on the subject. He tells also what they were, gives some of the catalogues. Generally there were none but religious books; sometimes a few classics, especially after the year 1100, when liberal studies were in fashion among the rich and great.

In 1305 there were 1100 volumes in the library of the Abbey of Ramsey. Of these there were:

70 Breviaries,
32 Grails,
29 Processionals,
100 Psalters.

There were five Greek books and seventeen Latin. But among the latter there was no Cicero, or Cæsar, or Tacitus, or Quintilian, or Pliny. It was clearly a miscellaneous collection, the volumes having been donated by different civilians.

In 1073 the Lord Chancellor of England presented to the Cathedral of Exeter, of which place he was bishop, seventy volumes, probably all on religious subjects. After 1100 the larger gifts of books contained one or more of the classics.

It is by these gifts, made by learned civilians and semi-secular dignitaries of the Church, and the fact that, as a general thing, the monasteries were respected in time of war, that in my opinion, the finding of classics in the monasteries can be accounted for. To infer that the monks copied them because they had them would be as loose as to infer that the Venetian Senate had copied the many valuable manuscripts found in their library, all which were either presented or bought.

HOW, THEN, WERE THE CLASSICS PRESERVED?

During the darkest of the Dark Ages, though there were no schools for the poor, there were some in many cities and towns for the children of the rich. The law school established at Beyroot in the fourth century, flourished until the conquest of the place by the Saracens. The school established at Bologna in the fifth century gradually developed into a university, at which about 1220 there were ten thousand students; and in 1300, fourteen thousand. The schools at Oxford and Cambridge grew into universities before 900; and in 1320 there were at Oxford 30,000 students. The school at Paris became a university soon after the first Crusade and had quite as many students as Oxford. Between the years 850 and 1000 there were many learned men and good academies in Germany. Before the year 1200 there were twenty-three universities in Europe, besides the Moorish universities in Spain, which were reputed the best of all. At all these institutions, grammar and rhetoric were taught; and these included a training in the Latin and more or less instruction in the Latin classics. Greek was not taught perhaps at any of them until after the invention of printing.

Schools of a lower order existed in all the cities and principal towns. Guizot (*History of Civilization*) gives a list of many which existed before Charlemagne; and that monarch established a great

many. A little after him and about 823 the King of Lombardy had, by edict, opened schools in nine of the cities in his dominions.

There were famous schools in Padua, Rome, Marseilles and Toulouse during the sixth and seventh centuries, and one at Carthage up to the date of the Saracen conquest.

As these schools were primarily secular, they created, each one about itself, a demand for classical works. Around each university there grew up again into prosperity the trades of the bookseller and the copyist, which had become insignificant during the reign of the monks. But these trades had at no time been extinct. Before and after the conquest of Rome by the Goths, there had been booksellers, stationers, antiquarians, copyists and illuminators. All these are spoken of by Cassiodorus a little after 500; by Isidor, about 600; and by Benedict, of Wearmouth, about 690; he visited the Continent five times to buy books. About 990, Gerbert, who afterwards became Pope Sylvester II., and who was a graduate of the Moorish university at Cordova, in Spain, and passed for a sorcerer because of his learning, wrote to a friend at Rome to procure him a copy of a book which, he said, could be had of some of the copyists, who, he adds, "may be found in all parts of Italy." In 1170, Peter of Blois, who had collected a good library, speaks of his buying from "public dealers in books," and gives an amusing account of his buying from a bookseller at Paris a book which he left at the store and which was taken off by force, by an eminent dignitary who was eager to have the volume.

In 1287 De Bury mentions having bought manuscripts from booksellers at Antwerp, Brabant, and Paris, and other cities in Europe.

About the same time, Dante was studying at Padua and Bologna where the students were supplied with books by dealers who employed professional copyists.

The booksellers were so important a class to the students in the university towns that the universities generally obtained legislative authority over them and subjected them to many rules. At Paris the price of books was fixed by the faculty; and the dealers were compelled to let books for hire at fixed rates to the students.

The prices and rates were quite low, not much higher indeed than those of a circulating library of our own days.

As the academies and universities, manuscript dealers, antiquarians, copyists and illuminators had co-existed for more than five centuries before the invention of printing; as the greater number of existing ancient manuscripts have been found not in the monasteries, but in the library of the Venetian Senate, to which Petrarch bequeathed all his books; in the library of Florence, built up principally by Lorenzo and Cosmo de Medici; in the library of Oxford, to which Wycliffe and Roger Bacon, each, left his collection; in that of the Vatican, the books of which were bought after the Middle Ages, by Nicholas IV. and Leo X., wherever they could find them; in the royal library of Paris, made up by the Government; and in other libraries of secular character; as there is no positive proof that, prior to the year 1178, a monk ever copied a classical book, and many facts making such copying highly improbable; as the classical books found in the monasteries are all easily accounted for by known donations by civilians and acquisitions made since the revival of classical learning; and as it was, in the language of one of the popes, Gregory, "a shameful thing that it should be said of a priest, that the praises of Jupiter and the praises of Christ should issue from the same mouth"; in other words, that a priest should study or teach the classics; is it unjust to deny to the monks what is now claimed for them by some Roman Catholic writers, the honor of having preserved those masterpieces?

WILLIAM BIRNEY.

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ICELANDIC LITERATURE.

IN his condensed compendium of mediæval and modern Icelandic literature, Dr. Finnr Jónsson admits that the Icelandic people have at no time displayed any marked tendency toward philosophical thought. This is also a widely accepted estimate among well-informed circles of the European continent, and it cannot be denied that the native historians of our national literature still neglect a series of important problems, among them the ethnological research of the prehistoric heterogeneous elements that have contributed to impart such a quaint and different aspect to the literature of Iceland. It seems sufficient to the native critics that Iceland's literary records will forever exert an irresistible fascination upon the modern nations, and that Icelandic literature in our day should have become one of the best exploited literatures of Europe.

As regards the heterogeneous origin of old Icelandic records, it is to be regretted that modern ethnologists, and above all the Icelanders themselves, should have done so little to have cleared up the remote prehistoric contact which must have taken place between Teutonic-Scandinavian tribes and the Finns,—men belonging to, perhaps, the highest type of the old Finno-Altaic race. The "hersirs" and tribal chiefs of Norway until the days of Harold Fairhair are admitted by several modern ethnologists to have been to a considerable extent "Norwegianised" or "Teutonised" Finns, who at the time still preserved several traits of their Asiatic-Tartar origin; and that these were the foremost emigrants to Iceland at the close of the ninth century of our era. The mythological and heroical traditions which these Norwegian-

ised Finns brought with them to Iceland, point to racial traditions which do not exhibit marked Teutonic elements. It is creditable to Iceland that many of these weird racial traditions have been preserved, but it was to be expected that at a later time they should be misunderstood and greatly distorted, particularly by the clerical Celtic-Icelandic scribes. The best preserved mythical and prehistoric sagas were those handed down orally by the popular saga-men for the entertainment of young and old, concerning old-time battles fought far inland in the East of Europe,—weird sagas, rude in form and contents, about kings and heroes, very unlike the Scandinavian kings and warriors of a later saga-time, —about mysterious potentates like King "Guðmundr á Glæsisvöllum"—King Gudmund of Splendid Plains—by which may have been meant the inland steppes to the southwest of the Ural mountains. Even the old Eddic lays, for which there is still lacking any satisfactory ethnological and critical interpretation, may have been evenly divided between Tartar and Teuton. It is certain that the contents and purport of the huge collection known under the title of *"Antiquités russes,"* edited at Copenhagen by the noted Danish antiquarian, Professor Rafn, must read like an unintelligible riddle to modern Icelanders and Scandinavians; and yet, it recalls to mind a recent incident at a session of the Icelandic "Althing" or Parliament. A member of the assembly was heard to encourage modern Finnish immigration as a desirable offset to the injury which American emigration was causing to the Icelanders.

This was an admission of a remote racial affinity, and, in fact, many Icelanders and Scandinavians may apply to themselves the recurring refrain addressed to Ottar in a lay in the afore-mentioned collection—*"Antiquités russes"*:

"Alt er það ætt þin,
Ottarr hinn heimski!"

"It is all your family,
Oh thou foolish Ottar!"

In mediæval Iceland there were no cities or villages proper. The leaders of the immigrant families, whether Norwegian Finns,

pure Teutons, or Norse-Celtic immigrants from the British isles, had settled widely apart on the banks of fjords, along inland valleys, in every available locality. Each had imported their own peculiar traditions and independent saga circles, and for a time led their own lives without very close ties of solidarity between the several ethnic groups. But our modern world has not an adequate idea of the astonishing literary activity, which, during the following centuries, must have reigned in the then wealthy homes of Iceland, at the respective Episcopal Sees of Hólar and Skálholt, in the famous school of Oddi, and in all the convents of the Island. The surprising wealth of manuscripts still existing in the Island in the centuries following upon the reformation forms a rich legacy bequeathed by Iceland to the world at large. The *"Habent fata sua libelli"* applies to the providential preservation of all these Icelandic manuscripts. While Icelandic annals relate the plundering of the treasures of Icelandic Episcopal Sees by the Teutonic reformers, it seems that the latter attributed little value to any kind of manuscripts. In Iceland, however, these accumulated literary treasures would have been lost to the world had not the patriotic Icelander Arni Magnússon conceived the idea of exporting the entire collection *en bloc* to Copenhagen, Denmark. In this connection we have to bear in mind the utter oblivion, neglect, and decay into which Iceland had sunk under the semi-barbaric government during the seventeenth and eighteenth centuries. At Copenhagen, however, fortunately there happened at the time to be found noble-minded, far-sighted Danes,—men like Luxdorph, A. Suhm, Schöning, Engelstoft, the native Icelander and Danish Premier Jón Eriksson, and others.

To the intelligent initiative of all these men mediæval Icelandic literature owes its first introduction to the European world in a series of splendid editions of the Eddic lore and of the most important saga texts, the expense of which was liberally defrayed by the Danish monarchs themselves, and this ought also to be considered as the first genuine step taken toward a national Icelandic literary revival. The Icelander of the early saga period remained

still a man of action, who merely had exchanged the sword for the pen. Whether "Skáld" or "raconteur" saga man, he was prompted either by family pride, or inspired by events leading to the triumph or defeat of some party, but during the golden period of Icelandic literature, from Ari Thorgilson down to the historians of the thirteenth century, the literature has been changed essentially both in form and in utterance under the Celtic, clerical culture of the times. The brilliant historian Snorri Sturluson and his contemporary historians, several of them the inmates of Icelandic convents, belonged to this classical school. It is the only period in which Icelandic literature displays something of inward continuity and of philosophical thinking. All of the writers of this period, in style and utterance, aimed at the "Romanisation" of the old Norse language. They even applied it to several older saga texts; but, not by any means, so intelligently to the mythical saga lore; yet, here I do not expressly allude to either the young or old Eddic texts. The Romanisation, however, put its stamp upon some of the old family sagas, such as the "Niál's Saga,"—regarded by critics as a prominent type of a racy Icelandic saga. The dialogue, for example, between Flosi and his relation Hildigunnr reads like any creditable specimen of impassioned Roman rhetoric. This classical tendency may be said to have advanced one step further in the charming "Biskupa-Sögur" or lives of Icelandic bishops before the Reformation. These "Biskupa-Sögur," by their style and language, read like highly attractive modern biographies. The modern natives shrink from the apparently naïve faith which inspired the mediæval works, like the "Biskupa Sögur," or religious poems, as the strenuous poem "Lilja," by the monk Eystein Asgrimsson; but the Icelanders are apt to forget that, besides naïve faith, those works are also inspired by the same lofty aspirations which prompted the deeper modern thinkers to recognise the inborn ethical cravings of mankind as high above any worldly wise logical ideas. For the rest, at a later period of uncommon national distress—the "Volœ̈is" period of the seventeenth century—the broken-hearted, contrite Icelandic people, although nominally

Lutherans, returned to that early fountain-head of naïve Icelandic faith; from an analogous source, likewise, was inspired the great seventeenth century psalmist, Hallgrim Pétursson, and others who sought for spiritual strength and faith in the destinies of the Icelandic people.

As regards the existence and intrinsic value of modern Icelandic literature, foreigners need no longer abide by the efforts of native Icelandic writers, but may be referred to men and women of different European nationalities who have made the Icelandic language and literature a favorite object of study. Of those residing in Germany I shall here mention only the names of M. Phil. Carl Küchler, Fräulein M. Lehmann Filhes of Berlin, and, above all, Poëstion, the distinguished Vienna librarian and worthy translator, critic, and historian of modern Icelandic literature. Modern Icelandic literature in our own day still may produce the impression of a series of unequal, incomplete efforts devoid of continuity and originality, except, perhaps, in its short story and lyrical poetry. But we should remember that there had to be performed a long and arduous preliminary work, mainly philological and linguistic, before there could be any modern national literature.

Until nearly the middle of the nineteenth century none but Icelandic students at Copenhagen were available for the work of reading, correcting, and translating the manuscripts which Arni Magnusson had given the Royal Library at Copenhagen. And this, at a time when in Iceland the native language had practically ceased to exist, or to be the official medium for transacting public business. An abominable Danish-Icelandic jargon was largely spoken by the upper classes. A practical Icelandic grammar did not exist in Iceland until the well-known Danish linguist Rasmus Rask introduced his own short Icelandic grammar in the early decades of the nineteenth century. A few years later the Icelanders also formally date their modern literary revival from the foundation of the review *Fjölnir* at Copenhagen, by a group of gifted and patriotic natives. The articles of the *Fjölnir*, in a short time, seem to have revolutionised both the spoken and written lan-

guage of Iceland. I here refrain from entering into details, but again refer the reader to Poëstion's work, or to Dr. V. Guðmundsson's Danish treatise, *Island's Kultur ved Aarhundredskiftet*, 1900, tranlated into German by R. Pallaske. The old literature of Iceland, in a multitude of aspects, and in its highest classical form, was mainly the outcome of Celtic-Icelandic genius, and of the classical Christian culture of the time.

In the present literary stagnation and even widespread indifference to past literary traditions which is said to prevail in Iceland, it is well to recall to mind that of the 20,000 emigrants, who in late years have settled in America, the majority probably has been made up of Icelanders of Celtic descent. The *American-Icelandic Press* of Winnipeg, Manitoba, occasionally keeps reminding Iceland of this fact. Some of the quaint poems of the Icelandic-American poet Stephan G. Stephansson, in rather drastic language. seem to express the genuine sentiments of a self-confessed modern Icelandic Celt. The Iceland of to-day, according to this writer, is only a sort of "Teutonised" Iceland, dull, realistic, and utilitarian; and apparently he is not "in touch" with the time-serving faction of Dano-Icelandic *chauvinists*, who affect to seek an imagined center of intellectual, political, and racial solidarity in the mediæval literature of Iceland. But on the other hand it is only too true that modern Iceland is actually confronted by a number of perplexing and difficult, political and economical problems; and for the satisfactory solution of these we devoutly trust that Jove will grant to the long-abiding island all the required life through the ages.

A. Högni Gunlogsen.

THE CHRISTIAN DOCTRINE OF RESURRECTION.

JAMES S. RIGGS, D.D., and Professor at the Auburn Theological Seminary, expresses in a recent number of the *Biblical World* his conviction that the Easter message of the resurrection of Christ is an indispensable part of Christianity which should not be surrendered to the demands made by the *Zeitgeist*. A distinction has been made between the Easter message (viz., a belief in the bodily resurrection of the Christ) and the Easter faith (viz., a belief in the immortality of the soul) and the *Zeitgeist* urges us "to accept the latter, but to reject the former as impossible in view of modern enlightenment. In other words, an actual resurrection as the church has commonly understood it did not take place, and yet Jesus lives."

It is true, as Professor Riggs states, that "the immortality of the soul is not a scriptural expression," it is a modern invention. The Gospels believe in "a resurrection of man, body and soul." Redemption includes the whole man. To strike out therefore that side of the truth which shows that the body as well as the spirit is to enter into the true conception of complete immortality, is to miss the real climax of all the teachings of the Scriptures regarding the future of man. Jesus "brought to light this wondrous completeness by coming himself from the grave. . . . . the fact of the resurrection, therefore, is of the most importance." *

It is quite true that according to the early Christians "the Easter message belongs with the Easter faith." The question is only whether we can still believe it. Professor Riggs sees no diffi-

* See Acts xvii. 32; 1 Corinthians xv. 3, 14, 20.

culty; he claims that the "vision theory runs up against stubborn, inexplicable obstacles." Considering all the evidence he says "the empty grave is most satisfactorily explained by the actual resurrection of Jesus," and he argues that it is better to let "the faith of the disciples rest upon the fact of the resurrection than upon God-inspired visions given to create belief in a fact which after all was not a fact." In the opinion of Professor Riggs, "the surety of the fact" is sufficiently vouched for by historical evidence and the value that it possesses for us cannot be underrated by any Christian believer.

No doubt Professor Riggs voices the opinion of the orthodox traditional conception of Christianity, which believes not so much in the immortality of the soul as in the resurrection of the flesh, but a new interpretation of the Christian faith is preparing itself in the minds of the people, and we regard it as most significant that a representative of the more liberal view rises in the person of the scholarly Canon of Westminster, one of the most distinguished clergymen of the Church of England.

Canon Hensley Henson's article on "The Resurrection of Jesus Christ" has created a stir in the religious world because the Canon openly expresses his conviction that a belief in the bodily resurrection of Christ is not essential to true Christianity. He knows very well and grants that in the days of early Christianity the belief in bodily resurrection was regarded as the most important part of the faith. Further, Paul says: "If Christ has not been raised then is our preaching vain, your faith is also vain." But the belief in a bodily resurrection is only evidence of the materialism of the early Christians who could not conceive the truth of immortality otherwise than in the form of a resurrection of the dead body. The Canon is fully informed of the arguments which theological scholars adduce in favor of the resurrection of the body of Christ, but he has also carefully investigated the reports of Biblical criticism, and he comes to the conclusion that it cannot be set aside lightly or easily. He says:*

"The candid Christian, we say, when reading these statements

* *The Hibbert Journal* for April, 1904, pp. 476-493.

cannot escape the inference that the evidence for the quasi-historical statements of the Creed is of a highly complicated, dubious, and even contradictory character."

He further says of historical criticism, the youngest of the sciences, that "it cannot claim even such a measure of recognition as that which the older sciences have succeeded in wresting from the Christian Church; but the analogy between the course of events by which the conclusion of astronomy, geology, and biology have, one after the other, been, so to say, domesticated within the theological sphere, and the course of events by which the conclusions of historical criticism must undergo the same process, is, at every point, complete."

St. Paul himself, though he insists on the fact that Christ has been "raised from the dead," repudiates at the same time a materialistic conception of the resurrection, and Canon Henson adds:

"The dissolution of the physical body in the grave will not, we are assured, hinder the process of resurrection in the case of Christ's disciples."

Therefore the Canon concludes that a physical resurrection cannot be an essential part of the Christian faith. "The emptiness of the sepulchre might conceivably be as little worthy of credence as the materialistic details in St. Matthew xviii. 9 and St. Luke xxiv. 36 ff.*" Quoting Bishop Westcott, the Canon proposes to replace the words "the Lord was raised" in the apostolic conception of the resurrection by the words "the Lord lives," and the real proof of the resurrection should be found in the fact that Christ lives and works still.

Canon Henson's article is a remarkable evidence that the world moves. If he, the Canon of Westminster, can, without being excommunicated, make this statement which we ourselves proposed a few years ago as the only possible solution of the essential doctrine of Christianity, we see the time near at hand when the philosophy of *The Open Court* will be regarded as good Christian doctrine, orthodox not from the standpoint of the traditional conception of dogma-

* Cf. Acts x. 41.

tism, but in the sense of being a doctrine that is tenable before the tribunal of science which is true orthodoxy, for it is rightness of doctrine; it is doctrine that is universally acceptable, and therefore genuinely catholic.

There are heroes in battle and there are also heroes in the domain of thought, and we do not underrate the courage of Canon Henson to scorn all equivocation and make his statement boldly and plainly, risking the enmity of the narrow-minded whose number is legion and the alienation of many of his friends and co-religionists.

The belief in immortality is the crucial point of Christianity. Formulated as the doctrine of resurrection it embodies it in a quasi-allegorical form, but we ought to bear in mind that the Gospel stories of Christ's rising from the dead and his ascent into heaven are later additions which were not part of the original Gospel, and we ought to understand that they are true in an allegorical sense. They reflect the truth of immortality. It may not be out of place to reprint here the passage of a former article of ours which was the subject of Canon Henson's discussion:

"Considering the sanctity that was attributed to Sunday among the Gentiles, especially the disciples and similar sects, it was natural that Easter Day, the festival of Resurrection, should have been celebrated on the first Sunday after the Passover.

"The burden of the Christian Gospel as preached by St. Paul is the message of the resurrection of Christ, in which the apostles implicitly believed. Whatever we may think of the accounts of it in the New Testament we must grant that the doctrine of immortality is the quintessence of the Christian religion, which was the cause of its final triumph. The oldest account in the Gospel according to Mark makes the simple statement that the grave was found empty, and this suggested at once to his followers the idea that Jesus must have risen from the dead. The immediate result was visions of the departed master. He was seen by Mary Magdalene, by St. Peter, by the eleven apostles, then by more than three hundred brethren, and finally by St. Paul.

"One of these visions (that of St. Paul) lies within the pale of historical investigation, and, in spite of the contradictions discov-

ered in the several versions of the event, offers nothing that seems improbable or inexplicable.

"The history of the Gospel stories of the resurrection has been traced by the higher critics, and we may briefly state that later reports, superadded to the original account in Mark of the empty grave, show the spirit in which the early Christians regarded the idea of Christ's resurrection. Paul's Christ is a spiritual presence, while the Christ of a later writer, hankering after a corporeal immortality, is a bodily presence who makes doubters touch him and parades his corporeality by eating in the presence of witnesses. Finally he is reported to have departed from the earth by ascending to heaven.

"Perhaps the most beautiful conception of the risen Christ (incomparably nobler than the crude materialistic notion of a corporeal resurrection) is reflected in the tale of the disciples of Emmaus, where Christ, the departed master, speaks out of the mouth of a stranger whom they meet on the way and with whom they break bread together. They knew him not until he was gone. And how did they know him? His words were the words of Jesus, and the way in which he broke bread and spoke the blessing reminded them of their beloved master. Who will deny that in this sense Christ has proved a living presence ever since and is still so even unto the generations of these latter days?"

EDITOR.

AN ANCIENT MOSLEM ACCOUNT OF CHRISTIANITY.

ABU-'L-FATH' MUH'AMMAD, a Persian author of the twelfth century, in a book on religious sects and philosophers, describes the Nazarenes, or, as we would say, the Christians, in the following terms:*

"They are the Church of the Messiah, Jesus, the son of Mary. He is the true messenger after Moses, who is promised in the law, and he accomplished manifest signs and splendid miracles, such as raising the dead, healing the blind and the leprous; and his existence and very nature were a perfect wonder to [attest] his genuineness: viz., his origin without initial drops of seed, and his wise discourses without any previous instruction. Whereas, with all the prophets inspiration reached its completion in the fortieth year, he was already inspired to speak in the cradle, and the completion of inspiration took place in his thirtieth year; and the time of his calling lasted three years, three months and three days.

"Then, after he was taken up into heaven, the apostles and others were of different opinion concerning him. But the opinion differed upon two points only: Firstly, how he had come down and united himself with his mother, and how the Word became flesh; secondly, how he had ascended up and united himself with the angels, and how the divided Word existed. As to the first point, they held that the Word became flesh, and they had a [manifold] view upon the

* Translated from the German of *Abul-'l-Fath' Muh'ammad asch-Schahrastani's Religionspartheien und Philosophen-Schulen.* Zum ersten Male vollständig aus dem Arabischen übersetzt. Von Theodor Haarbruecker. Halle: 1850-1851, 2 vols.

manner of the union and the incarnation, brought into a system. Some said that he enlightened his body, as light enlightens transparent bodies; others, that he was imprinted into it, as the impress of the seal into wax; others, that he appeared in it, as the spiritual appears in the corporeal; others, that he clothed the Godhead with the manhood as with a coat of mail.

"Lastly, others believe that the Word was mingled with the body of the Messiah, as milk is mingled with water. They hold that there are three persons in God. They say the Creator is one substance, whereby they understand his existence by himself alone, not the inclusion of space and comprehensibility (*Greifbarkeit*). And it is one in substantiality, but three in personality; and by three persons they understand the attributes, such as existence, life and knowledge, the Father, the Son and the Holy Ghost; and only the knowledge has put on the body as a coat of mail, not the three remaining persons.

"As regards his Ascension, they maintain that he died and was crucified; the Jews put him to death out of envy and malice and knowledge of his prophetic calling and dignity. Death, however, extended not to the divine part, but only to the human.

"They say that the perfection of the human personality consists in three things: the prophetic office, the imamhood, and the Lordship. The other prophets had these three distinctions or one of them as attributes, but the rank of the Messiah is a higher one, in that he is the only Son, and no one is like him, and between him and the other prophets no analogy is possible; and he is the one through whom the sin of Adam is atoned for, and who will judge the creation.*

"As to his second coming, however, they are likewise of different views. Some say that he will come down before the Resurrection day, as the disciples of Islam maintain; others think that he will only come down at the day of judgment. However, he came down after he was dead and crucified, and Simon Peter saw him, and he [Jesus] spake with him and transmitted to him the power. Then he left the

* Die Schöpfung richten werde.

world and ascended into heaven, and Simon Peter was his vicar, and was the foremost of the Apostles in whatever related to knowledge, piety and culture; only that Paul disturbed his work and made himself his colleague, and confused the foundations of his knowledge and mixed it with the *Kalam* (i. e. view) of the philosophers and the insinuations of his thought.

"I have seen an epistle from Paul, which he wrote to the Greeks, wherein it is stated:

" 'Ye believe that the position (*Stellung*) of Jesus is like that of the other prophets, but it is not so, but he is only to be likened unto *Melchisedek, king of Salem,* to whom *Abraham gave tithes,* so that *he blessed him* and laid his hand upon his head.* Wonderful is it, to wit, what is delivered in the Gospels, that God said: Thou art mine only son—as if he who is the only one could be likened unto other human beings!'

"But there are four of the Apostles who agree together, and one of them made a compilation (*Zusammensttellung*) of the Gospel. They are Matthew, Luke, Mark and John. The close of the Gospel of Matthew reads that he said: 'I send you to the nations, as my Father sent me unto you. Go and call the nations in the name of the Father and of the Son and of the Holy Ghost.'†

"The beginning of the Gospel of John is: 'In the beginningless eternity was the Word, and this Word was with God, and God was the Word, and all is made by his hand.'

"Later the Christians divided themselves into seventy-two sects, and the chief sects are three: the Melchians, the Nestorians and the Jacobites. From them went forth the Julianists, the [Basilians?] the Macedonians, disciples of Macedonius; the disciples of Sabellius, of Photinus, of Paul of Samosata, and several more."

* * *

The statement that Jesus appeared especially to Peter after the

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* The words in italics are in Hebrews vii. 1-3, but the whole text is either quoted loosely from memory, or else from some lost epistle of Paul to the Greeks. The former is more likely, for what follows is probably a reminiscence of Heb. i. 5.

† A confused quotation from John xx. 21 and Matthew xxviii. 19.

resurrection and transmitted to him the power has been supposed by Rohrbach, in his monograph on the lost Mark-ending, to be based upon that lost ending or upon some document derived from it. Mark is Peter's Gospel, and often contains details omitted by Luke and Matthew; and yet the apparition to Peter mentioned by Luke and Paul (Luke xxiv. 34; 1 Cor. xv. 5) and intimated by the extant Mark (xvi. 7) does not appear in the present ending of that Gospel. A tenth-century Armenian MS. found by Conybeare ascribes the present ending to Aristion, a second-century writer; and this, coupled with its absence in the oldest extant Greek manuscripts and in ancient ones known to Eusebius and Jerome in the fourth century, have forced upon us the conviction that it has been added to supplant the genuine ending. Mary had evidently written something which was disapproved of by the Church, and Rohrbach's monograph exhaustively discusses this question. There is one point, however, which the German scholar overlooks. We know from Irenæus that Mark, in the second century, was alleged by the Docetists in favor of their doctrine that Jesus the man suffered, while Christ, the divine principle, remained impassive (Iren. Haer. iii. 8:7). One is strongly tempted to conjecture that Peter's original account of the resurrection was simply that of a vision or apparition, such as the one that appeared to Saul on the Damascus road, and which Saul himself, in the text from Corinthians quoted, collocated with the undetailed appearance to Peter. When I mentioned this conjecture to Rendel Harris in 1900, he seemed to approve of it, and said: "Yes! His body was phantasmal." To have allowed such an account to stand in the New Testament, when the Docetists were becoming a dangerous party in the Church, would have given them too much hold. Peter's narrative of his experience was therefore suppressed, and only lingered in apocryphal tradition. As the Mohammedans always quoted certain apocryphal Gospel stories on a footing with the Canonical ones, our Persian author may have gotten his statement from such a source. He can hardly have taken it from Clement of Alexandria's lost *Institutions* (ap. Eusebius H. E. ii., 1), for that work put Peter on the same footing with James and John, and taught that all three of them received the gnosis from the risen Lord. It is strongly probable, therefore, that there was once a Gospel narrative telling about a special appearance to Peter, and the celebrated charge to Peter, now misplaced in the Gospel of Matthew, was a likely portion thereof.

PHILADELPHIA, PA. A. J. EDMUNDS.

INFINITUDE AS A PHILOSOPHICAL PROBLEM.

PROFESSOR C. J. KEYSER'S VIEW WITH EDITORIAL COMMENTS.

PROF. CASSIUS JACKSON KEYSER, a mathematician of Columbia University, well versed in the philosophy of mathematics, especially in its more recent development since the appearance of Riemann's famous *Habilitationsschrift*, has published in *The Hibbert Journal* an article on "The Axiom of Infinity," which he criticises in its rôle of "a new presupposition of thought." He says:

"For thousands of years philosophy has recognised the presence of a certain definite problem, namely, that of *extending the dominion of logic, the reign of exact thought, out beyond the utmost reach of finite things into and over the realm of infinite being*, and this problem, by far the greatest and most impressive of her strictly intellectual concernments, philosophy has, for thousands of years, arduously striven to solve. And now I ask—not, has it been worth while? for that is conceded, but—has she advanced the *solution* in any measure, and, if so, in what respect, and to what extent?"

Professor Keyser, continuing, says that "thanks to the subtle genius of the modern Teutonic mind, this ancient problem, having baffled the thought of all the centuries, has at last been completely solved." He then refers to Riemann, Bolzano, Dedekind and Cantor. The first mentioned mathematician distinguishes clearly between boundlessness and infinitude, and Professor Keyser selects for the purpose of his discussion the following definition of "that august term":

"An assemblage (ensemble, collection, group, manifold) of elements (things, no matter what) is infinite or finite according as it

has or has not a PART *to which the whole is just* EQUIVALENT *in the sense that between the elements composing that part and those composing the whole there subsists a unique and reciprocal (one-to-one) correspondence."*

For a distinction of the notions of finite and infinite he quotes the mathematical theologian Bolzano, saying:

"Bolzano's procedure is virtually as follows: Suppose given a class *C* of elements, or things, of any kind whatsoever, as the sands of the seashore, or the stars of the firmament, or the points of space, or the instants in a stretch of time, or the numbers with which we count, or the total manifold of truths known to an omniscient God. Out of any such class *C*, suppose a series formed by taking for first term one of the elements of *C*, for second term two of them, and so on. Any term so obtainable is itself obviously a class or group of things, and is *defined* to be finite. The indicated process of series formation, if sufficiently prolonged, will either exhaust *C* or it will not. If it will, *C* is itself *demonstrably* finite; if it will not, *C* is, on that account, *defined* to be infinite. Now, say Professor Royce and others, a definition like the latter, being dependent on such a notion as that of inexhaustibility or endlessness or boundlessness, is negative; a certain innate craving of the understanding remains unsatisfied, we are told, because the definition presents the notion, not in a positive way by telling us what the infinite actually *is*, but merely in a negative fashion by telling us what it is not.

"Undoubtedly the claim is plausible, but is it more? Bolzano affirmed and exemplified a certain proposition, in itself of the utmost importance, and throwing half the needed light upon the question in hand. That proposition is: *Any class or assemblage (of elements), if infinite according to his own definition of the term, enjoys the property of being equivalent, in the sense above explained, to some proper part of itself.* Though he did not himself demonstrate the proposition, it readily admits of demonstration, and, since his time, has in fact been repeatedly and rigorously proved. Not only that, but the converse proposition, giving the other half of the needed light, has been established too: *Every assemblage that* HAS *a part 'equivalent' to the whole,* IS *infinite in the Bolzano sense of the term.*

"I turn now to the current assertion by Professor Royce and Mr. Russell, that the modern concept of the infinite, of which I have given above in italics an exact statement, to which the reader is referred, in fact denies a certain ancient axiom of common sense, namely, the axiom of whole and part.

"The question is whether it is possible, by means of the new concept, to demonstrate the existence of the infinite; whether, in other words, it can be proved that there are infinite systems. That such demonstration is possible is affirmed by Bolanzo, by Dedekind, by Professor Royce, by Mr. Russell, and in fact by a large and swelling chorus of authoritative utterance, scarcely relieved by a dissenting voice. After no little pondering of the matter, I have been forced, and that, too, I must own, against my hope and will, to the opposite conviction. Candor, then, compels me to assert, as I have elsewhere briefly done, not only that the arguments which have been actually adduced are all of them vitiated by circularity, but that, in the very nature of conception and inference, by virtue of the most certain standards of logic itself, every potential argument, every possible attempt to prove the proposition, is foredoomed to failure, destined before its birth to take the fatal figure of the wheel.

"The upshot, then, is this: that conception and logical inference alike presuppose absolute certainty that an act which the mind finds itself capable of performing is intrinsically performable endlessly, or, what is the same thing, that the assemblage of possible repetitions of a once mentally performable act is equivalent to some proper part of the assemblage. This certainty I name the *Axiom* of *Infinity*, and this axiom being, as seen, a necessary presupposition of both conception and deductive inference, every attempt to 'demonstrate' the existence of the infinite is a predestined begging of the issue.

"What follows? Do we, then, *know* by axiom that the infinite is? That depends upon your metaphysic. If you are a radical *a-priorist*, yes; if not, no. If the latter, and I am now speaking as an a-priorist, then you are agnostic in the deepest sense, being capable, in utmost rigor of the terms, of neither conceiving nor inferring. But if we do not *know* the axiom to be true, and so cannot deductively prove the existence of the infinite, what, then, is the

probability of such existence? The *highest yet attained.* Why? Because the *inductive* test of the axiom, regarded now as a hypothesis, is trying to conceive and trying to infer, and this experiment, which has been world-wide for æons, has seemed to succeed in countless cases, and to fail in none not explainable on grounds consistent with the retention of the hypothesis.

"Finally, to make briefest application to a single concrete case. Do the stars constitute an infinite multitude? No one knows. If the number be finite, that fact may some time be ascertained by actual enumeration, and, if and only if there be infinite ensembles of possible repetitions of mental processes, it may also be known by proof. But if the multitude of stars be infinite, that can never be known *except* by proof; this last is possible only if the axiom of infinity be true, and even if this be true, the actual proof may never be achieved."

We agree with Professor Keyser when he expresses his conviction that the existence of the infinite cannot be proved, but we venture to supplement this brief statement of his views by the following suggestions: By infinite we understand a process which is to be carried on incessantly. If we think of a mathematical straight line as being produced without limits, we call it infinite. Should we ever try to draw on, even if it were done only in thought, we should soon find out that our line is always of a definite length and never truly infinite, for we would need an infinite time to complete the task. The rigor of logic forces us to admit that infinitude is a process in action, but not a concrete and ready thing. Whether the number of stars or the grains of sand on the seashore are infinite or not is a question which can never be decided by experiment, but if our logical laws hold good, and if they possess any value at all, we must admit that (if our existence were widened into a divine omniscience and omnipotence) we could most easily count the grains of sand on our planet (assuming that there is no quibbling about their size as to which ones are mere dust, being too small to be counted) and we could with no less facility determine the number of stars that course within the range of our milky system (provided again that no doubt exists as to which celestial bodies should be regarded as

stars and which as mere meteorites or stellar dust); for anything that is concrete must be definite and anything that is infinite can never be a concrete thing, but must be a process in progress.

This appears to amount to a negation of the existence of infinity; and perhaps it does, at least in the opinion of those metaphysical philosophers who identify the term reality with substantiality, or even with materiality; but the infinite is after all actual, for it inheres in activity which wherever we take it is always an infinite series. Moreover, every particular part of the universe may be considered in its relation to the whole; yet the present moment in its relation to other moments in both the past and the future is but a fleeting point in infinite time, and every spot that determines a definite locality may in all directions and at any imaginal distance be placed in relation to the surrounding world, which renders the proposition obvious that the infinite is the potentiality of actual existence, and is as such not less real than the finite. The present moment alone is truly existent, and the "here" is to us the centre of the universe. It is the place in which our activity is real, but the directions which it can pursue as well as the distance to which, at least in thought, it may venture, are alike infiinite.

Infinitude is an evanescent quality; it comes or goes according to the viewpoint we take, according to the task we set ourselves. Take, for instance, the line *AB*, which may be one mile, or one foot, or one inch long, just as small as you see fit. It is finite; yet you can divide it and there is no limit to your division. It is infinitely divisible. Thus you create infinitude by a conceptual viewpoint. Or take a definite number, e. g. the fraction 1-3; it is a definite quantity, but if we change it into a decimal fraction, the result is an infinite decimal fraction, viz., 0.3333 . . . . to be continued without end. If we ever stop the fraction is no longer equal to 1-3. Yet this infinite decimal exactly equals the unequivocally finite and definite faction 1-3. The infinite fraction 0.3333....can never be completed, the definite fraction 1-3 is complete. The infinite and the finite are not two different things, but they are two aspects of the same reality. The finite hangs in the infinite as a temporary and concrete actualisation, and the infinite is inherent in the finite as the

inexhaustible potentiality of its activity. The finite is the changeable, the non-permanent, the transient. The infinite is the resource of all possible existence illimitable in its possibilities.

This conception of infinity seems to be a negation of its existence; and assuredly it is a negation of the notion that infinitude can ever be a concrete thing, realised in any place or at any one time, or in any material body or collection of bodies. But while it denies the materiality, the concreteness, the definiteness (or let us directly add, the finiteness) of infinity, it yet implies its actuality as a most prominent feature of the world-process. Infinity is an intrinsic quality of all activity, and as such it is the most essential part of reality constituting its profundity and the mysterious charm of its eternal youthfulness and freshness; for if it were not, reality would be monotonous, and if not meaningless, certainly both shallow and trite because exhaustible in meaning.

LITERARY CORRESPONDENCE.[1]

FRANCE.

IF we accept the theory of evolution—limiting it to the psychological structure of the human individual—we are led to accept also the priority of the emotional life to the intellectual life. And from this follows as immediate consequence that the emotions must have their own logic, anterior to rational logic and different from it in its forms and means, but having the same object, filling the same function in the life of the species.

This further consequence is derived from our premise, that, despite the usual complexity of the phenomena of personality, there can and must be cases of purely emotional memory, that is to say, cases in which the emotional states are recalled by memory and recognised as such independently of the sensorial or intellectual phenomena that accompany them. And, as a necessary accompaniment to this, there must finally exist forms of the creative imagination which are also emotional, affecting only the emotions, "having for their material emotional states and nothing else." Thus the higher mental life would find itself closely united to the physiological trunk by intermediate stages without any break whatever. This is, in brief, the succession of dominant ideas which are developed with remarkable precision and clearness in the most recent works of M. Th. Ribot. To his *Psychologie des sentiments,* and his *Essai sur l'imagination creatrice,* has just been added *La logique des sentiments,* which completes this phase of his work: and this work is nothing less than a total reconstruction of the science of psychology.

[1] Translated from the original manuscript by W. H. Carruth, University of Kansas.

M. Ribot (I may limit myself here to a brief analysis of the work) considers in logic not simply the ensemble of rules, which determine the conditions of a proof, but also the natural facts, individual or collective, the emotions, beliefs, opinions, etc., which furnish a part of the materials for the reasoning process. "This man's judgment is influenced by his feelings," "passion has its logic," are expressions familiar to each one of us: they have a greater import than one thinks before reflecting. M. Ribot faces the subject in its true aspect and in its general features: he assumes the judgment itself to be a primitive element; he does not separate reasoning from the other operations that accompany it in the work of the mind; in a word, he treats the operations called logical as simple facts, without concern for their form or their validity. From his point of view it appears directly that the logic of feeling is very much the most vivid and widespread, and, to use his own words, that "primitive reasoning is to the reasoning of the logicians as the implements of the stone age are to the perfected tools of our own time."

In a preliminary discussion he establishes the fact that we must not expect to find the conditions of structure and connection of emotional reasoning in association: association reveals only the terms of the judgment and the reasoning; we must see also the relations. Emotional reasoning takes association for granted, but goes beyond it: the emotional temperament makes a choice among the states of consciousness, it has an end in view, consciously or unconsciously, neglecting or suppressing whatever tends to turn it aside from this goal.

Contrasted as they are, emotional logic and rational logic have a common foundation in reasoning. Even though the mechanism of the reasoning differs, it retains in both cases its characteristic mark, it is "a mediate operation the end of which is a conclusion." It might be said in objection to this that the logic of the feelings would then be confused with *sophistry*. But M. Ribot shows that they are not in all points coincident. There is a difference between them in both point of view and procedure. Sophisms may be wholly lacking in emotional quality, and emotional reasonings may be

entirely free from sophistry. Rational logic cannot cover the entire domain of knowledge and action; the logic of the feelings serves man in all the cases where he has an immediate interest in assuming or justifying a conclusion.

Emotional logic has, then, its own field; there follows naturally the study of its constituent elements. Its terms are judgments with an emotional coefficient, "judgments of values," variable, subjective, not always consistent, which reasoning will transform on occasion into objective and general judgments. As for the relations which connect these terms, it will be sufficient to note that emotional reasoning sets out from a wish or a belief; that it accordingly proceeds toward a desired goal, toward an end which has been accepted in advance; that the conclusion therefore conditions the sequence of the arguments from which it is predestined to issue, which arguments are in this case not merely words, but in addition gestures, acts, intonations, etc.; and, finally, that the logic of the feelings differs from the other kind by being exempt from the principle of contradiction, since the values of sentiment may be contradictions to the reason and yet reconcilable in practice.

How diverse are the forms assumed by the logic of the feelings may be imagined from the preceding analysis. M. Ribot designates them provisionally by the following epithets: passional (or emotional), unconscious, imaginative, justificatory, mixed or composite; he describes their several manifestations. But yet, whatever be these forms, if we ignore their substance, their content, the logical agency peculiar to each one, their individual ends, and consider only the part that contributes to the general aim of the individual, we find that they may be reduced to two types, according as they contribute to the conservation or to the expansion of the individual—these two fundamental tendencies of emotional life which are so intimately connected in the higher animals.

M. Ribot, I may say in passing, pays some attention, and with good reason, to the subject of religious conversions. It would seem to me to be very interesting to study the reverse situation. I do not doubt that the analysis of certain cases would prove very

instructive. But I can not tarry over this point at present, and I now come to the last portion of M. Ribot's work.

The logic of the feelings has a character fundamentally practical. However, one case constitutes an exception: this is when it is employed in the service of creative esthetics. Even here, it is never reduced to pure association; it is probable that some sort of reasoning is involved in the genesis of every esthetic creation. For my own part I am inclined to affirm this. Does there exist by any possibility a form of emotional creative imagination dealing exclusively with emotions? This is the new question that awaits solution.

M. Ribot has undertaken to prove that musical creation alone of all presents this character. He does indeed show how poetry, as soon as it tries to be purely emotional, tends to approach the type of music, neglecting the sense of the words and listening only to their sound. Similarly with painting when it sacrifices technique to visions seen in dreams.

However, I would make one reservation, or rather a suggestion, on the subject of the division of musicians into two groups, according as they see in their art only an architecture of sounds, a form, an arabesque, or on the other hand as they value in it only the expression of passion. The extreme positions would be those of the composer who would think out his music as one figures out a game of checkers, and again of the musician who would reduce it to some sort of soul without body. But, in fact, it seems to me that all the masters keep between these two practically unattainable extremes; the two methods are really inseparable, at least in practice. The constructors of arabesques cannot wholly escape some sense of grace, of voluptuousness, cannot repress all tendency to expression, nor, on the other hand, can the musicians of passion altogether resist the charm of combinations. There are not wanting in the works of the most passionate masters pages which bear witness to a regard for ingenuity or even have their origin in the fondness for some concourse of sweet sounds.

The exceptions which may be pointed out will not break down the thesis,—that the fundamental condition of the emotional creative

imagination is "the disposition to be moved not simply by actual events, but by memories of feelings, that is to say, by the emotional memory, and to build with these materials just as the imagination with a sensational basis builds with forms and colors." However, we must not demand of the musician that he necessarily and absolutely realise the type. After all is said, the musician works in sounds as the painter works in colors. The language of each of the arts is the peculiar discovery of that art, and music itself, be it ever so mystic, appeals to a sensory pleasure which at least serves as support or as vehicle for a feeling.

If we consider, on the other hand, that many poets and painters also represent the emotional type, we shall be led to the conclusion that this disposition to build with materials of an emotional character is independent of the special—psychological—endowment which makes this artist a poet or a painter and that one a musician. But this gift afterwards reacts upon his character because of the media peculiar to the language which his endowment indicates and imposes upon him. It is the very quality of sound that makes it to an artist of an emotional temperament a more adequate and more immediate instrument than color. The language of sounds is a creation of man, even more so than the language of colors. In fine, it would seem that hearing is, if I may venture to say it, a more intimate and interior phenomenon than sight. We are obliged in some sort to go outside of ourselves in order to see something outside, and this is one of the reasons for the opposition of these arts, an opposition, which, while common, is not constant, not always so pronounced in many individuals.

In short, there remain for me certain difficulties inherent in the thesis, and I publish them now as they occur to me, expecting to get more light by so doing. M. Ribot has such clearness and force that I am not quite sure but the mistake is mine. However, it is time to leave his fascinating volume, over which I linger in spite of myself. It will stand among the most original works that have thus far been written by this unchallenged master of French psychology.

The work of M. Th. Ruyssen, *Essai sur l'évolution psychologique du jugement,* touches in some points that of M. Ribot, and follows the same method. The main thesis of M. Ruyssen involves, in fact, the following procedures, which are, moreover, intimately connected—the application of the genetic method to the study of the judgment, and the extension of physiology into psychology.

Philosophers hitherto have studied the judgment as exemplified in judgments,—the completed judgment of the adult or even of the child. According to the particular doctrine of each philosopher the judgment has been regarded as an operation of the intelligence, an act of the will, etc. And the intervention of the will, of desire, has led to the paying greater attention to the part of the physiological concommitants, sensations, movements, etc. When once the method of the natural sciences was introduced, the investigators became more bold; they have attempted, and not without success, to apply the genetic method to the operations of the mind: for example, they have undertaken to determine the manner in which judgments are formed, of what elements they are composed, and what paths are travelled by the mind in forming judgments.

M. Ruyssen intends to push this investigation still further. He takes note not only of the composition and evolution of our judgments; he would attempt to go to the heart of the matter and report the formation of credulity, that is to say, of the habit developed within us of judging and believing. Accordingly, judgment will not be considered henceforth in its isolated exterior products; it will be traced back to the fundamental acts of life, studied as a function in the process of evolution of the individual himself just as deeply as it may be possible to follow it. Physiology must illumine, if not explain, the psychological process.

But how shall the transition be accomplished? What principles may be followed in connecting the evolution of the judgment with that of life? M. Ruyssen hopes to find them in these two great facts: habit and adaptation, which are met under different aspects at every step of the ladder of life: the tendency to perpetuate the

vital stimuli, and to respond (with an excess of energy, he adds in italics, following Spencer) to the stimuli most favorable to living.

It is evident that spontaneity is a prime fact involved and recognised, without which we could not conceive either habits or adaptations. It is no less clear that we can scarcely refuse to recognise something like a rudiment of consciousness in the elementary manifestations of life. M. Ruyssen does not flatter himself that he will find the first states of consciousness of the child emerging from "a sort of psychic vacuum or non-existence," but rather, as he puts it, "from a background at once extraordinarily complex and solid of psychological states obscurely perceived and of habits unconsciously acquired." The repetition of acts beneficial to the organism will be, in brief, the initial point. It takes a liberal step to get from this to the clear consciousness of these relations and the construction of the edifice of logic. On the genesis itself of our faculty of judgment we have no direct light; we have been able only to try to untangle the vital reasons of our tendency to affirm, to judge, and to believe. M. Ruyssen has announced no pretention of teaching us more than this. In the very interesting pages in which he studies the attention, doubt, belief, etc., and which constitute the subject of another part of his book, he follows, indeed, the ordinary processes of psychology. I have not the time to pursue this further; it will suffice to have characterised his meritorious attempt. His work marks one of the most pronounced steps that have been taken toward the solution of a problem of first importance.

* * *

To what class of feelings the esthetic feeling belongs; to what other feelings it is related; what place these feelings occupy in the life of the individual and the species; to what characteristics in things the sense of beauty in us corresponds; by what signs the peculiar sense of beauty is recognised; under what forms and in what circumstances it is manifested; from what capital the various arts are enriched; in what proportion the passions of the soul and rational motives unite to form them: these are some of the problems that present themselves to us as soon as we begin to discuss the origin of art, its expression, its nature. The very title of the im-

portant work of M. Paul Souriau, *La beauté rationnelle,* shows us that he does not propose to attack them all, and that he has devoted himself especially to establishing, in accordance with his conception of the term, the plan of a system of esthetics calculated to bring together divers theories and to formulate general principles which would assure a practice at once rational and more conscious of its object and its means.

Perhaps this title will rouse the apprehensions of some readers. Let them be reassured, M. Souriau does not approach his subject in an autocratic spirit; he begins his study where we might all begin it, excepting that we would not carry the theory of subjectivity in art to the extreme point of denying all relation of appropriateness between the qualities of things and the impressions that we receive from them. He concedes that esthetic judgments "are perhaps the most subjective, those into which we put the most of ourselves and involve our personality most profoundly."

But for all that, not everything here is personal; objective judgments are "implied in all our judgments of taste." These are the elements which it is necessary to eliminate. It is necessary to subject our esthetic judgments to rational supervision, taking them just as facts, experience and acquired notions have made them to-day, instead of going back to the Deluge. And if, on the other hand, this work of supervision leads back constantly to reasons derived from self-interest, from our knowledge, from our dignity, M. Souriau accepts the reproach which may be brought against him of confounding esthetics with logic, with science, with morals, for it is precisely toward such a fusion that it is tending with all its might.

Determination of the idea of the beautiful, sensual beauty, intellectual beauty, moral beauty,—these are some of the divisions under which the author's arguments are arranged. Starting, in accordance with his programme, not from experience nor from evolution, but from reason, he posits to begin with these two principles: beauty is evident perfection, and perfection is the conformity of a thing to its purpose, so that the domination of purposes will give us that of perfections, the most elevated purpose that we can

possibly conceive being the full flower of conscious life. Accordingly the beautiful and the useful, while remaining distinct ideas, are no longer antagonistic;[2] intelligence will contribute, furthermore, to beauty, since its ultimate function is neither to know nor to comprehend, but to arrange actions with a view to an end; morality and beauty consist alike in the perfection of the being, or at least tend toward it.

I am giving only the skeleton of the theory, which is richly and very clearly developed. One cannot but approve of M. Souriau's designs. It has always seemed to me, as it does to him, that every work of art is subject to one essential condition, that it shall not contradict either our scientific logic or our moral logic. It is a hackneyed truth, that the perfection of man is the ultimate object of our sciences, of our rules of life and of our arts, over and above the pleasure which they yield us. It would even be legitimate to conceive of esthetics as "the complete science of sensation and feeling," (as did only recently the much to be regretted Durand de Gros), ethics being regarded as a branch of it: in fine, the science of application or of adaptation, under the general principles of which would be grouped morality and artistic creation, each having its own theory, its own methods of instruction, and its own technique.

Some time since (in *Dix années de philosophie,* p. 141) I wrote that art is more or less directly useful in so far as it favors the exercise of natural faculties (this being the biological point of view), in so far as it ennobles the individual and strengthens social bonds (this being the ethical point of view), and also in so far as it is a variety of knowledge and reveals to us something of man and of exterior nature (this being the scientific point of view); nevertheless it remains distinct both by virtue of its means of expression, its language, and by virtue of its immediate end, which is a specific

[2] On this point I have always thought that the utility of an object does not detract from its beauty, but nevertheless it will not suffice to create it: the beauty lies in the manner of expressing the useful. This consideration should never be neglected in the judgments which we form on architecture especially; economic utility produces many ugly results here, which are still further aggravated by a false art.

pleasure, or an emotional state and at the same time an intellectual pleasure. Some further explanations would be necessary here, but a more thorough discussion of the subject would exceed the limits of this correspondence. I must take leave of M. Souriau, thanking him for his work and his criticisms. His book is important and timely in the midst of the confusion of our schools. Yet I will not offer to guarantee its efficiency.

* * *

M. Marcel Mauxion, in an *Essai sur les éléments et l'évolution de la moralité*, makes a careful analysis of the idea of the good. He reduces the elements of morality to the following three: the esthetic element, to which individual perfection corresponds; the logical element, to which correspond justice and law; and the sympathetic element, pity and love. The view which is particularly his own is the genetic exposition of these elements. The development of the esthetic element has, in his opinion, always prepared the way and fixed the conditions for the rational element, which in its turn has preceded that of the sympathetic element. Whence is derived this practical conclusion, that it will be impossible to base morality upon either one of these elements to the exclusion of the others, or to invert their natural and rigorous order.

Incidently I would note an excellent criticism of the theories of what is called solidarity,—one of those words on which it is fashionable to build to-day without considering exactly what they signify. The little volume of M. Mauxion deserves to be read and studied.

* * *

The Monist has already published an account of the volume of M. Fr. Paulhan, entitled *La fonction de la mémoire et le souvenir affectif*. Therefore I may be excused if I do not devote so much attention to it to-day as the value of the work would demand. M. Paulhan maintains the reality of emotional recollections (this question of emotional memory seems to be the order of the day), but not without letting it be seen that he mingles with them constantly intellectual recollections: moreover they both present the characteristic of being constantly modified, separated, or transformed ac-

cording to new circumstances. They tend to organise themselves into systems which will become the foundation of the individual and will be useful to him. In fine, and without entering into the analysis of the facts, which are so numerous and so complex, we have here a painstaking study of the mental mechanism looked at in an especial light and connecting with the general theory of "systematic finality," which has been presented by M. Paulhan with sufficient detail in his previous works.

* * *

M. Malapert's *Le caractère*[3] is a very complete and interesting work. The reader will find in it a history and a profound criticism of the attempts at classification proposed in recent years, the economy of which I have previously pointed out in the present journal. I think it best to reproduce here the remark made concerning M. Malapert's work by M. Alfred Binet in the last volume (10th year) of the *Année psychologique.* It is impossible, M. Binet thinks, to study characters in the lump and at one sitting; but one can study and observe particular traits of character very well by putting oneself in favorable conditions called forth if need be by the observer himself. The wise method to follow, would be to obtain from nature, series of reactions which one would then group and classify in order to select typical reactions. Attempts at classification based upon theoretical views seem to me, as they do to M. Binet, to have yielded all that they are capable of yielding, and I think with him that investigators would make a mistake to linger in the path that has been followed until now. It is better to use a longer but doubtless a more fruitful method.

* * *

Here we have a volume of particular interest for American readers, that of M. Emile Lauvriere, *Edgar Poe, sa vie et son œuvre.* The mere name of Poe gives sufficient ground for conjecturing that it is a study of pathological psychology; such it is, and the most complete that has ever been written, if I am not mistaken. Poe's clinical table is startling. The relations of the work to the tempera-

[3] Paris, Doin, pub. Works without any publisher's name are from the house of F. Alcan.

ment of the poet seem to be apparent. It is no exaggeration to say, in accordance with the documents here collected, that "the poetic originality of Poe was his affliction"; his imagination was "the projection of his defects into literature." And yet, M. Lauvriere remarks, the critical sense of the man, his studied taste, his conscious logic succeeded in organising into a harmonious work discordant elements which seemed incapable of yielding anything but the incoherence of delirium. "Poe's lucid reason triumphs over his irritated sensibility; his art subdues his madness."

In another place (*Mémoire et imagination*) I have undertaken to show that the attention persists in the improvisations of the poet and the dramatist, that the judgment continues to play its part even in the midst of rapid and inspired performance. I have pointed out, besides, in connection with the declarations of certain writers, the watch kept by the poet over the automatic march of the images of his fancy, the constant and efficient presence of the reason, despite a seeming subdivision and distraction of the ego and of the unconscious operation of a stranger who might have entered upon the scene. The example of Poe, in my opinion, supports the truth of this observation and supports the assumption of the constant presence of the critical sense. It also permits us to demonstrate that the effect of troubles combined with a tendency to degeneracy is not to prevent this activity of the reason or the critical faculty, but rather, at first and in the majority of cases, to supply the imagination with imperfect materials. It would be a really instructive study to disentagle, in certain chosen and particular cases, the precise influence of the various pathological states upon the production of the artist and the poet; only in this way would the much debated question of the relation of genius to madness find any proper answer. And it is in fine a chapter of such a study, a very important chapter, which M. Lauvrière has presented to us.

* * *

M. Guy de Charnacé has published under the title *Hommes et choses du temps present*[4] independent articles in criticism on works of philosophy, esthetics ,and science. Himself an eminent

[4] 2 vols., Paris, Emile Paul, pub.

zootechnician, the Marquis de Charnacé is particularly instructive in the pages where he treats of Groos, Metchnikoff, Lebon, etc. Evolution finds in him a persistent adversary. He is further interesting in the pages devoted to volumes on psychology, sociology, or metaphysics, for here he takes up the questions as a man of the world who has lived his life, and he finds in his "common sense" of an enlightened and inquisitive reader objections which too frequently escape the specialist shut up in his study. His attitude is clear and frank: he takes the position of a Catholic and a Christian, yet without narrowness.

There remain for me to name, without at present being able to say anything about them, the following works: M. Queyrat, *Les jeux chez les enfants;* MM. Toulouse, Vaschide, and Piéron, *Technique de psychologie expérimentale*[5]*;* M. A. Lévy, *La philosophie de Feuerbach;* M. Rémy de Gourmont, *Physique de l'amour, essai sur l'instinct sexuel*[6]*;* L'abbé Laberthonnière, *Le réalisme chrétien et l'idéalisme grec*[7]*;* M. Le Dantec, *Les influences ancestrales*[8]*;* M. Brunetière, *Sur les chemins de la croyance*[9], a work which will demand a thorough discussion. Etc.

LUCIEN ARRÉAT.

PARIS, FRANCE, December, 1904.

POSTSCRIPT. I have just received a copy of the *Revue de philosophie,* managed by M. Peilloube (4th year, No. 11).[10] This excellent review is not unknown to the readers of *The Monist.* It is well arranged, liberal, and offers to its readers the means to follow the philosophic movement. I will mention in this number a very complete report of the International Congress of Philosophy, held at Geneva, of the Congress of History and Sciences, also held at Geneva, and of the Congress of the British Association for the Advancement of Science at Cambridge.

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[5] Doin, pub. [6] Mercure de France, pub. [7] Lethielleux, pub.
[8] Flammarion, pub. [9] Perrin, pub. [10] Chevalier et Rivière, pub.

CRITICISMS AND DISCUSSIONS.

AN INTERNATIONAL AUXILIARY LANGUAGE.

To the Editor of The Monist.

I am late in thanking you for your kind gift of the July *Monist* containing so many interesting articles on the international language. The cause of my delay is found in the many claims upon my time and particularly in the Second International Congress of Philosophy, which met at Geneva from the fourth to the eighth of September. I take pleasure in informing you that the Congress, after having heard my report on the progress of the notion of an international language, took the following action:

1. It endorsed the platform of the Commision on the adoption of an international auxiliary language.

2. It renewed my appointment as member of the Commission, which I had received from the first session of the Congress at Paris in 1900.

3. It appointed as a new member of the Commission Prof. Ludwig Stein, of Berne, who has long been in sympathy with our undertaking and who spoke in its behalf at the Congress.

It seems to me that these results are of sufficient importance to deserve communication to your readers and that they cannot fail to be interested in them.

If I did not fear to trespass on your indulgence I should add a brief reply to the objections raised by yourself and M. Arréat, polite and appreciative though they be. Permit me to say that they are all due to an incorrect or too narrow conception of the problem, or even to a simple lack of information. I will begin by taking up those which are based upon simple errors of fact.

You say, for example (p. 565), that the devotees of Volapük in different countries have had much difficulty in understanding one another. On the contrary, at the International Congress of Volapük, held in 1889, people of all countries conversed and held discourse in Volapük with great ease and understood one another perfectly. Volapük has even made marriages (I could cite the names) of persons of different nationalities who had no other com-

mon language. To-day Esperanto has accomplished still more completely what you regard as a miracle: this summer there have been several meetings of French and English Esperantists at Havre, Rouen, and Dover, and they all conversed continually in Esperanto with the greatest ease and familiarity. You may confirm this by inquiry of the British Consul at Havre, or of the Mayor of Dover.

Moreover, the unheard of and almost incredible fact was observed, that the English who spoke Esperanto had none of that characteristic accent which marks them forthwith when they undertake to speak French! This in response to M. Arréat who still doubts whether an artificial language can actually be spoken (p. 563)! If my personal testimony has any value I will record the following fact: I have never learned to speak Esperanto; I only read it. Now a Russian Esperantist came to my house one day unexpectedly and addressed me in Esperanto. I understood him perfectly without losing a single word of his conversation (which never happens to me with either a German or an Englishman), and without any preparation I was able to reply to him in Esperanto and make myself perfectly intelligible to him (which I should not be able to do in English, and only with difficulty in German). Draw your own conclusions! You (and M. Arréat) say that an artificial language would not be easier to learn than a living language (pp. 563 and 596). This is an entire mistake! It is a hundred times easier to learn, because it is regular. Just think of what a marvel of simplicity you have in a language without exceptions! You speak of English as an easy language, because its grammar is a bit simpler than that of other languages. But you forget that it is quite as irregular as others, quite as full of anomalies and want of logic, that the English syntax frequently gives rise to equivocations (for example, in the deplorable habit of omitting the relative pronoun), and that English style swarms with idioms that are unintelligible to an uninitiated foreigner. Reforming English orthography and making it phonetic will not render English easier for foreigners to pronounce; this will simply make it more difficult to read.

M. Arréat says: "Is it not better to learn English, which puts me into touch with 150 millions of men?" Without discussing this number, which seems to me to be exaggerated (the number of those whose mother tongue is English is usually reckoned at 125 millions, and it is evidently unfair to add to this the number of foreigners who may know English, for in this case we must also add to the number of Frenchmen the number of those who can speak French, etc.), I will simply reply to this: I have not and shall never have anything to do with these 125 millions of people; but as trader and scholar I shall have to do with a thousand persons who speak English; but I shall also have to do with a thousand who speak German, with 500 speaking Italian, with 500 speaking Spanish, with 500 speaking Russian, with 200

speaking Dutch, with 100 speaking some Skandinavian language, and so on. What good will English do me with all these other people? Why should a Frenchman and a German, an Italian and a Russian use English in talking with one another rather than the national language of some one of them? Will my knowledge of English enable me to read the literary works and scientific publications of Hungary and Poland? This shows how absurd it is to propose any given living language whatever as an international language. You propose English because it is spoken by 125 millions of people. Why not propose Chinese, which is spoken by 400 millions? If it is a matter of numbers the Chinese ought to carry the day. Is it not better to be in touch with 400 million men than with 125 million? You see, your arguments are refuted by the *reductio ad absurdum*.

You allege that English language and literature are international (p. 595), and I may reply: Neither more nor less than the French literature, the German literature, the Russian literature (Tolstoy), and even the Skandinavian literature (Ibsen). This then is not a peculiar claim of the English, nor an argument in its favor. You think that it is spoken and understood "everywhere"; but go to Italy, for instance: French is the language spoken by all who have business with foreigners, and I have seen Englishmen very much embarrassed where a Frenchman could get along perfectly well. You accuse Mr. Ostwald of having a "national prejudice" against English, and you attempt to find political reasons for this (592). I am not prepared to reply to this in the name of the Germans, but I can affirm as a Frenchman that the animosities which you recall no longer linger among us, and that public opinion is favorable to "a cordial mutual understanding."

Permit me to say to you, that if any one is the victim of national prejudice it is he who proposes his own language as the international medium, and not the one who discards every national tongue, including his own, in favor of the international language. The exclusion of national languages, recorded in our programme, is a clause expressing mutual disinterestedness; it is the indispensable condition for any international agreement, and it may boldly be asserted that if an international language is ever adopted it will of necessity be a neutral one.

I know very well that you think very little of a formal and, as it were, diplomatic agreement, and that you expect the solution of the problem not from an agreement and a vote, but from the natural concurrence of languages. I have no objection; but you forget that the same national prejudices which were opposed to the official adoption of a living language are also invincibly opposed to its natural propagation. You invoke "the struggle for existence," "natural selection," and "the survival of the fittest." But precisely because they do struggle for existence national languages will not abdicate in favor of one from among their own ranks. As for natural selection, it may

just as well occasion the triumph of two or three languages or even of six, as of a single one; the problem will not be solved in this way.

But even this is a chimera: the Germans and Russians have not succeeded after a century in suppressing the Polish tongue, even when it would be to the interest of the Poles to use the language of their conquerors. And yet you expect that the English can ever suppress German, French, or Russian? English will be the universal language only when the whole world is English!—and even then it is not sure of dominion. Greek survived alongside of Latin in the heart of the Roman Empire and was the international language of the entire Orient; Roman emperors, such as Marcus Aurelius and Julian, wrote in Greek. And let me add, that you are dreaming of a universal language, that is, one common to all nations, while we are asking only for an auxiliary language, which will be learned in any case only by a minority in each country and which will leave the national languages as they are, with their natural territory and their peaceable rivalry.

But it is unworthy of philosophers to expect from constraint and violence the solution of a problem in civilisation. It is not by exciting national self-love and interest and by favoring dreams of universal conquest and megalomania that we shall succeed in making humanity better and happier: every appeal to violence is a relapse of civilisation, a return to barbarism. This is particularly true of the problem of an international language. This problem can be solved only by an agreement among civilised nations (whether this understanding be spontaneously developed, or under the official form which we are proposing in order to speed its realisation)—and by the adoption of a neutral idiom, which shall be equally intelligible for all the peoples of European civilisation, and whereby all may communicate together on a perfectly equal footing. Every time that a national language is made use of between two people of different race one of the speakers or writers is more or less sarcrificed or subordinated to the other; he feels himself to be in a position of inferiority, and this produces a sentiment of embarrasment and resentment. On the other hand, an auxiliary language is neutral ground, equally unfamiliar, or rather equally familiar to both parties, and one on which they feel themselves equally at ease. Here as everywhere else equality is the condition of fraternity.

LOUIS COUTURAT.

Postscript: I am glad to be able to announce that the "French Philosophical Society" determined on October 27 to support the Commission and appointed as its representative on the same M. Bergson, member of the Academy of Moral Sciences and Professor in the Collège de France, the well known and respected philosopher, who has long approved our undertaking.

EDITORIAL REPLY.

It is not our intention to enter into a controversy with M. Couturat, especially as we cherish toward his endeavor the most kindly sentiments and (in spite of our doubts) wish that his hope of an auxiliary international language might be fulfilled. Accordingly we shall here limit ourselves to a few statements in which M. Couturat has mistaken our attitude.

If an auxiliary international language will prove to be what M. Couturat expects of it we shall be most glad to use it and spread it all over the world. So far we have not yet been convinced of the usefulness of any of the auxiliary international languages, among which Esperanto seems to be the most promising one. Our doubts as to the success of Esperanto do not prevent us, however, from serving the good cause and making the ideal, as well as all the propositions to actualise it, known to our readers. That is all we can do under the present circumstances, and therefore our attitude is one of decided friendliness, not of hostility.

M. Couturat seems to be under the impression that I have proposed English as the international language. That is not the case. I have only used the spread of the English language as an instance how an international language will gradually establish itself and how it will conquer the world. I have not as yet declared myself an adherent to making English the international language. While English is at present the simplest language, I am perfectly aware of its many shortcomings among which I enumerated only a few.

When I said that English is no longer the language of the English but international I did not mean to declare that English is as yet *the* international language. I simply meant that English is spoken by other nations than the English. English is the national language of the United States as well as all the English colonies, which are so many budding nations, and practically also of South Africa. It is a fact that the bitterest enemies of England speak the English tongue. No more vigorous invectives against the English nation and the English government have been published in other languages than in English. English is spoken by the Irish and also by almost half of the anti-English Africanders.

My policy with regard to the adoption of an international language is simply the principle of *laissez faire*. I believe that the best adapted language will naturally conquer in the long run. Should English prove to be the simplest and best medium for an international exchange of thought, let English by its own intrinsic merit become the international language. If there be any other language, artificial or natural, that is superior, let it prove its superiority by being acceptable to the majority of mankind, and I believe that in a free competition in which we give fair chances to every one the fittest will survive.

Most assuredly I believe in the ideal that at last mankind will speak one language, and I trust that the time will come when mankind will have one civilisation, whose forms may differ but which is one in possessing the same moral ideals. Whether or not the different national languages will be preserved is a matter of secondary importance.

So long as the different nationalities still have a hold on the several races of mankind it seems to me that a pasigraphy would be the best and easiest medium of communication, and with this idea in mind, I have proposed my scheme as published in *The Monist,* Vol. XIV, No. 4, which is so far a mere general scheme but could, if completed by competent hands, be condensed into a grammar of a few pages, the principles of which could be learned within an hour by the mere perusal of a leaflet, and thus it would enable any traveller to make his wishes known to strangers while travelling among people with whose language he is absolutely unacquainted, if only he carries a grammar of pasigraphy along in the shape of a small pamphlet, written in the language of the country. PAUL CARUS.

SUGGESTIONS CONCERNING PASIGRAPHY.

I have been much interested in your suggestion of a new universal language, Pasigraphy, in the July number of *The Monist.* A few suggestions have come to my mind that I send you, thinking perhaps you might consider them while the language is still in an experimental stage.

To begin with, I am heartily in favor of your suggestion and think it altogether the most promising one that I have ever seen for a universal language. I do not think there is any hope of securing the universal adoption of any one language, on account of national jealousies, and I am not even sure that it would be advantageous, since many of the race differences which have been so effective in the building up of our complex civilisation in all its different phases would be wiped out if race and national differences were eliminated. It seems to me, however, that pasigraphy might well be tied up to English pronunciation in case it were to be widely used, English being so direct a language that few modifications would be required to make its grammar scientific. Still, I suppose a German could read pasigraphy if he wanted to, though it would never seem like German.

This brings up the matter of a phonetic system to accompany pasigraphy. For proper names some phonetic system must be used, and if the English pronunciation be given to pasigraphy the pronunciation could be figured in this phonetic alphabet for the use of beginners. I have not looked up Alexander Graham Bell's Scientific Alphabet, but it might perhaps be useful for this purpose.

The matter of fundamental importance, however, which occurs to me

is that in pasigraphy you will in the long run sacrifice legibility to convenience in writing. I believe Chinese will be easier to read than pasigraphy when you get a large vocabulary. Why not make your characters more complicated and then have a simplified form, as the Chinese do, for quick writing. The great advantage of Chinese characters that has been pointed out to me by an educated Japanese who knew English perfectly and which is, I believe also noticed by Williams, is the startling definiteness with which the idea stands forth when once the character has been mastered. We read words by their shape, and certainly the Chinese have more distinctive shapes than our own printed words where often some small mark, for instance, like the straight line of an *e* distinguishing it from a *c*, is all that separates widely different words.

However, the most important matter of all to my mind is the construction of a dictionary. I do not see that you have made any provision for this, which, however, must be made early in the development of pasigraphy.

As soon as you have a thousand characters it will be a hopeless task to hunt through them to find one that is forgotten or as yet unlearned. The Chinese system of a certain number of root characters out of which other words are formed by compounding might be used, or perhaps some system based on the geometrical form of the character. At any rate, some sort of a dictionary must be gotten up, and I believe you will be forced to compound characters in order to avoid having too many primary roots which would be difficult to find.

The awakening of China is at hand, and I believe a rational system of pasigraphy based on a world language could perhaps be adopted early in the development of that great country.

I hope you will devote a page in each number of *The Monist* to pasigraphy and ultimately give exercises, perhaps with keys, written in the new system.

All these are mere suggestions which grew out of my interest in your suggestion. I think it would be well for a commission to get together as soon as possible a grammar, elementary reader, and a dictionary, since I do not think it best to leave to the spontaneous efforts of experts the perfection of the symbols. The co-operation you speak of on page 582 would be essential to the proper development of the new language.

A last suggestion is that a society could perhaps be formed for the perfection of pasigraphy and that for the present it could be kept in an embyronic condition; that each member of the society be called upon to suggest symbols for new words, to be submitted to the council of the society; and that after a few months or years of such experimenting the language be put out in final form in such shape that it could be taught in the public schools and struggle for existence against Esperanto and other artificial languages. The

minute one tries to write a sentence one strikes the need for new characters, as you will see from the slip I enclose. From the results that I have seen in many lines of work I am much inclined to think that Mr. Cook's symbasis is as important in intellectual advancement as in organic evolution, and I believe its application to pasigraphy would be advantageous whereby the co-operating intelligences of many would be blended together to form as perfect a language as possible.

WALTER T. SWINGLE.

THE POWER OF POLITICAL INSTITUTIONS AS A FACTOR IN THE DETERMINATION OF THE WORLD LANGUAGE.

In the discussion of the theme dealt with in Dr. Ostwald's *Weltsprache* there is one phase of the problem that is usually left out of account, namely, the political force behind a language.

As long as Greece sent forth colonies the Greek tongue continued to spread. It is true, the rich and varied intellectual treasures of which it was the bearer counted for something, but they were not the most important factor in its expansion: this was the governments that were able to hold their own against the tribes by which those colonies were surrounded. As soon as Rome came into conflict with Greek peoples they had to give way to better organised political institutions. At first Italy and its islands ceased to be Greek; next the more specifically Greek lands followed and became to a greater or less extent Romanised. But in the East neither Greece nor Rome could long hold its ground in the face of the foes that appeared on every side.

On the basis of these facts and of others of a similar nature, what is the legitimate inference to be drawn? Every one who knows anything about the development of political institutions is aware that those worked out in England have more powerfully influenced modern thought than any other. More than two centuries ago continental writers began to point to the English representative system as the ideal government, while the English themselves have evinced very little inclination to change it. They go no farther than to admit the necessity of some modifications.

We are compelled by the events themselves to say that the English, using the term in its widest sense, expand because the government supports but does not lead those who go forth to make homes for themselves in new countries. The spirit of personal initiative and individual independence is carried abroad by the emigrants. Both the French and the Spaniards had the start of the English in getting a foot-hold on this continent, the Spaniards especially preëmpting the fairest portions of it; but neither held its possessions long or made much of its opportunities.

Professor Fouillée says in his *Psychologie du peuple français*: "At the end of the seventeenth century France had twenty million inhabitants, Great Britain and Ireland eight or ten millions, the present German empire twenty-one millions, Austria twelve to thirteen millions." He cites the authority of Leroy-Beaulieu to the effect that if a statistician had made a prophecy of the population of England at that time for about the year 1900 he would not have put down to the credit of the country more than eight or ten millions. Fouillée continues: "In 1789 France had twenty-six millions, Great Britain and Ireland twelve millions, the German empire thirty-three millions, Austria eighteen millions." It will thus be seen that one hundred years ago several European languages were more numerously represented than the English; for to the above we may add the Spanish and the Italian, to say nothing of the Russian.

How does the case stand now?

There are in North America not less than eighty millions who speak English. In the rest of the world, outside of Great Britain and Ireland, there are probably eight millions more. We thus get a total of English-speaking people greater than the whole population of the Russian empire, in which, however, a large portion of the population does not speak Russian. Toward the end of the sixteenth century England had only five millions of a population, and a hundred years later it had gained only a million. From that time on the increase has been almost marvellous. At the present rate, which there is no reason to believe will be materially checked within the next century, it is not hard to see that by the year two thousand English will be the *Weltsprache.*

CHARLES W. SUPER.

CLARENCE L. HERRICK. OBITUARY.

We publish in this issue a posthumous article of Dr. Clarence L. Herrick, well known in the scientific world for the services he rendered to the University of New Mexico in his capacity as President, and among neurologists as the Editor of the *Journal of Comparative Neurology,* the standard periodical of its kind in this country. The Editor of *The Monist* has been in correspondence with Dr. Herrick for a long time and during past years carried on a friendly controversy in the neurological journal concerning the seat of consciousness. Of late Dr. Herrick had sent a manuscript for publication in *The Monist,* "On the Passing Away of Materialism," and the date of its appearance had been fixed for the present number, but unfortunately Dr. Herrick, who had suffered for a long time from ill health, passed away on Thursday morning, the 15th of September. The following condensed statement of his career is extracted from the *U. N. M. Weekly* of

Albuquerque and advance sheets of the *Journal of Comparative Neurology*, kindly forwarded by his brother, Prof. C. Judson Herrick:

"Prof. Clarence L. Herrick, M. S., Ph. D., was born in Minneapolis, Minn., in 1858. He graduated with high honors from the University of Minnesota in 1880. A year was next devoted to hard study and careful research in the University of Leipsic. In 1885 he accepted the professorship of geology and biology in Denison University, Granville, Ohio. Much success crowned his efforts there, but in 1889 he accepted the chair of biology in the University of Cincinnati. It was here that he founded the *Journal of Comparative Neurology*, of which he remained editor-in-chief up to the time of his decease.

"After another season of study in Germany and return to Denison, Professor Herrick became distinguished in the scientific world. In America there was not his superior as a neurologist. The University of Chicago elected him to a chair of biology. A naturally vigorous constitution, however, now gave way, even under forty years of age, owing to his unremitting zeal and toil, and he sought the almost hopeless expedient of the climate of New Mexico.

"Here out-of-door life and his intense interest in nature so far restored him to health that he successfully held the presidency of the University of New Mexico for some time, but ill-health again obliged him to resign that important post.

"During his last year there was an obvious failing of physical strength, so that long field trips had to be abandoned. But the more quiet life gave opportunity for a thorough recasting of many questions and formulation of matters which had been in his mind all his life. So that before his death much of the philosophical correlation, of which mention has been made, was effected. A number of articles have already been published in the philosophical serial bearing on these matters, and there is a considerable collection of manuscripts remaining, much of which can doubtless be edited for publication. It is gratifying to know that he had the satisfaction of seeing this work so well rounded out before his death, and that the later months of his life were much more restful than those preceding, some of which were marked by extreme suffering. He continued in about the usual health until September 8, when he again had a series of uncontrollable hemorrhages, daily becoming weaker until on the morning of the 15th he peacefully passed away.

"The end came in accordance with his own most earnest wish—he fell fighting for the truth. As one of those who were near him when he passed away has said: 'He was taken literally "in the harness." His laboratory and study tables showed the unfinished tasks. His morning mail brought its usual load of duties. He had contributed an article to the September number of the *American Geologist*, and his mail on the morning of his death brought

a request from Dr. N. H. Winchell for some further contributions to the October number. Thus in the midst of his labors he passed into the larger sphere.'

"In estimating the character of his work it is difficult to say whether he was primarily an investigator or a philosopher. And this is to his great credit, for he combined in a remarkable degree the qualifications of an expert in both of these lines. He had at once acute perceptions and keen insight for scientific details, and a broad philosophic horizon and perspective, which peculiarly fitted him for the work he undertook of throwing light upon the nature of consciousness from the neurological side."

"The aim of his life was to throw light upon just such so-called insoluble problems as the relation of consciousness to the brain. 'Ignorabimus' is a word which never fell from his lips. The unity of the material and the mental is a truth upon which he came to lay increasing stress in his later years. Starting from a Lotzean spiritualistic idealism he never lost hold of the monism which characterises this philosophic world-view, though in many respects he worked beyond it, his scientific studies serving to correct any tendency to an exclusive emphasis upon the mental.

"In the memory of his pupils Professor Herrick was greatest as a teacher. This statement can only be appreciated by those who knew him personally and were in his classes. There was no display of oratory. He was not what would be called a gifted public speaker, though he was often called upon for such services. It was in the class-room or about the seminar table or in general conversation that the inexhaustible fertility of his thought and fine suggestiveness of his language appeared. In his lectures one always knew that he was getting the best, the latest, the deepest results of his scientific research and philosophic reflection. Never was any work slighted in which his students were involved. Other things might be sacrificed—time, money, convenience, even health itself, but never the student."

BOOK REVIEWS.

RELIGION AND THE HIGHER LIFE. Talks to Students. By *William Rainey Harper*, President of the University of Chicago. Chicago: The University Press. 1904. Pp. lx, 184. Price, $1.00.

Dr. William Rainey Harper, President of the University of Chicago, is one of the strenuous men of the present generation. He is not only an exceedingly active administrator of the Chicago University but also a good teacher. In fact, in his specialty as Professor of Hebrew he has no superior and scarcely an equal among his colleagues. And here we have before us a book of his in which he shows the methods and tendencies of his influence upon the students entrusted to his care. It allows an insight into Harper the educator. Its sub-title "Talks to Students" indicates the spirit that characterises him as college president in his pastoral work.

Religion in President Harper's opinion is indispensable for obtaining the higher life. He says:

"Religion is not the mother of art, science, philosophy, and ethics. Religion is not to be identified with one or all of these. Religion is not the enemy of art, science, philosophy, or ethics. Religion is independent of these phases of the higher life, but closely akin—in fact, the oldest sister of the family. Religion is essential for the fullest development of these phases of the higher life. Religion must have certain characteristics to work in harmony with them."

President Harper speaks of religion in general, meaning those essential features which all religions have, or ought to have, in common, but the religion which he has first of all in mind is Christianity. He sees not the Christianity of any special church or sect, but Christianity in the broadest sense, which he calls "the religion of Jesus Christ":

"The religion of Jesus Christ is a religion capable of adjustment to any and every individual, however peculiar his temperament, however exacting his demands. Its simpliciity, as the Master himself presented it, is marvellous. In its proper form it has always stood the most rigid tests; and it appeals as strongly to the reason as to the heart. It will permit you to respect your friend's religion; if he is a Jew, because it came out of Judaism;

if a sincere follower of Islam, because much of Islam came from it; if a disciple of some Eastern faith, because its founder, Jesus, was broad-minded and tender, and saw the truth wherever it existed, without reference to the name it bore. It is a religion of ideals, not weird and fanciful; but chastened, strong, and inspiring to true service. It is ethical in a sense peculiar to itself, for it is the religion of the Beatitudes and the Golden Rule. It is a religion that says: "Come unto me all ye that labor and are heavy laden, and I will give you rest.'

"The greatest minds of nineteen centuries have found this religion helpful. I do not urge upon you any special *form* of this religion, for I have in mind its very essence, that which is common to all forms, that which makes it the power history shows it to have been through all these centuries. This, as found in the teaching of Jesus, is, in the words of old Hebrew philosophy, the fear of the Lord—i. e., belief in and acceptance of One who has power to help, even to the uttermost. This step, this position, this opening of the mind and heart to an influence of the highest spiritual character, will prove to be the beginning, and indeed, the chief part, of that higher life which lies before you, that higher life upon which you have already entered, and in which, we trust, your walk will continue, until there comes the next step forward—the step that will usher you into the life still higher, the highest life—the life beyond."

It will be of special interest to notice the position of President Harper with regard to the significance of the Bible and Biblical criticism in his pastoral work, for President Harper belongs to the higher critics, and we may even say that he is one of the boldest among them. It is a matter of course that he finds the Bible still indispensable, and he mentions the problems connected with Bible study among the difficulties that beset our path in trying to realise the higher life in religion. These difficulties to the scholar are mainly of a purely intellectual, not a moral or typically religious, nature and do not hinder the honest Christian from realising his ideals. President Harper says:

"These intellectual difficulties may continue to exist without being settled in *any* way, and still one's faith may remain unaffected. Faith in Jesus Christ and in the living principles of Christianity is not bound up or in any vital way connected with the outside intellectual difficulties which are all the while presenting themselves to us. You have your difficulties; some one else has other difficulties. The result should not and need not affect one's active Christian life."

Whichever way the intellectual difficulties may be settled, the great fundamental principles of the truth will remain standing as on a rock, and a good Christian will not have his confidence in them shaken. The Bible has

been and will forever remain a book that should be used for instruction and education, a book that will teach us the truth.

As to Biblical criticism, President Harper says:

"To be sure, I reserve the right for myself to decide that one book of the collection has more of religious truth in it than another. Who, for example, would deny that the nineteenth psalm was not more helpful than the first chapter of Chronicles? I reserve the right also whether this or that book is really to be taken as one of the collection. Luther exercised this privilege. Why should I not enjoy it also? I reserve the right, still further, to decide for myself in what way I shall interpret this passage or that. When I read:

> 'The mountains skipped like rams,
> The little hills like lambs,'

I am at liberty to believe that it is poetry and not to be taken literally. So likewise when I read,

> 'Sun, stand thou still upon Gibeon,
> And thou, moon, in the valley of Ajalon!
> And the sun stood still and the moon stayed,
> Until the nation had avenged themselves of their enemies,'

and see that it is poetry, as it is shown to be in the Revised Version, and that it is obviously quoted from that ancient collection of poetical pieces, the book of Jasher, I understand that I may believe the Bible, without believing at the same time that the sun and moon stood still."

"For relief from difficulties of every kind, whether of life or thought; for a help which may always be obtained; for a rock on which firm standing-ground may be gained—go to the Bible; not as to some talisman possessed of magic power, but as to a book containing story after story which tells of God's dealings with man; to a book containing precept upon precept, richer in truth than any other of the world's possessions—a book which will guide your thought unfailingly to the only source of wisdom, to the source of all wisdom—to God."

"Every Christian man should face this question: 'Is the Bible what I have supposed it to be? If so, it is for me to treat it differently, to make it the subject of systematic study, and, through acquaintance with it, to come closer to God; to know him better, and, having this knowledge, to realise, as I have not hitherto realised, my responsibility to my fellow-men.' No man need ever fear that he will attain too large a knowledge of these sacred books."

President Harper is a Christian but he believes in an American Christianity, the Christianity as it is developing in the United States. He concludes his book with this remark:

"Centuries will pass; and gradually humanity will come to recognise the

significance of love; gradually Jesus the Christ will come to reign in the hearts of men. In this work of educating humanity to understand God and itself, America is the training school for teachers."

A TREATISE ON COSMOLOGY. By *Herbert Nichols.* Vol. I. Introduction. Cambridge, Mass., 1904. 8vo. Pp. 455. [Copies can be purchased from the author, 219 Commonwealth Ave., Newton Centre, Mass. $3.50.]

The first paragraph of Helmholtz's immortal memoir *Ueber die Erhaltung der Kraft,* declares that the proposition that perpetual motion is impossible and the proposition that all the phenomena of physics can be explained by (indeed he says "are due to") attractions and repulsions between pairs of particles, are "identical," meaning, of course, experimentally identical. But before many years had flown, it began to be clear to the minds of most of those who had examined the question that they were so far from being identical in the phenomena to which they would give rise, that the proposition about work was true, while the proposition about pairs of particles was false. It was certain phenomena of the elasticity of crystals which first brought this conviction to the few who were masters of that difficult subject. Next, those most significant of all chemical phenomena which are called the phenomena of the unsymmetrical carbon atom spread the wave of doubt to a wider circle. But what awakened physicists in general to the doubt was the difficulty of forming any adequate and purely mechanical or even hydrodynamical theory of electricity. The problem with which physical theorists were thus confronted goes by the name of the question of the constitution of matter, though the laws of motion are as much thrown into question as is the nature of ordinary matter. This question has been the chief subject of discussion in theoretical physics for many years. Some of the chief hypotheses which have been propounded for its solution have been the vortex theory, the electron theory, and Hertz's theory of concealed constraints. In the introductory volume of his *Treatise on Cosmology,* Dr. Herbert Nichols, who is already well known as a psychologist of high attainments in physics, and who here shows himself to be remarkably well-read in German philosophy, produces a new theory in competition with the three we have mentioned. The exposition of it occupies about a quarter of the volume. This theory, however, is not confined to matter, but is at once a theory of the constitution of matter and of the constitution of mind, having a thoroughly *monistic* character. It is based upon a philosophy which may fairly be described as a modification of Wundt's system, and thus gives a pretty fair idea of what that system would amount to when worked out into physical science. It is probably from that point of view that it will excite such interest as it may come to excite. This, however, is not the most interesting part of the volume.

Considerably more than another quarter of it is occupied with describing in detail what one may call a list of sensualistic categories. These are Quality, Quantity, Changeableness, Lawfulness, Presentativeness, and Personality. This is the part of the work which has most interested the reviewer (who is decidedly opposed to the author's nominalistic sensationalism, and less decidedly to parallelism,) and which seems to him to show very considerable power, although little of an analytic kind. But for the consideration that the kind of power shown is not that which is most needed, it might be rated much higher. But even from the author's point of view the reviewer would expunge Quantity and add a category in order to have some place in the system for false notions, which are certainly a part of the phenomena of mind. But it is truly astonishing that a man should be so blinded by his theory as to declare that "by no power of imagination can we conceive of any similarity whatever" between any two of his six categories. (This seems to be the meaning, although the precise words quoted are only applied to one pair.)

A little less than a quarter of the volume is occupied with a "Historical Review of Cosmology within Philosophy," meaning, mainly, German philosophy. This shows thorough learning, is agreeably written, and will prove instructive to physicists as well as to others who are not well read in philosophy.

As the doctrine is a modification of Wundt's system, so the method may be said to apply a modification of Wundt's logic. But it is to be feared that it will afford more comfort to Wundt's logical opponents than to his friends, if any application is acknowledged. If we might indulge in a little parody, we should say the form of syllogism seemed to be as follows:

Anaxagoras said *A*,
Wundt says *B*;
Ergo, I will risk saying *C*.

However, this introductory volume only sets forth a hypothesis; and it is to be hoped that the main body of the work will subject this to the severest experimental tests. It is, at any rate, certain that such sincere and single-hearted work must do much to bring the day when philosophy shall have entered upon the course of a true and progressive science; and from that point of view we must acknowledge that, be its errors what they may, it is certain to be a source of benefits to mankind. CUSP.

KOHELET ODER WELTSCHMERZ IN DER BIBEL. Ein Lieblingsbuch Friedrichs des Grossen. Verdeutscht und erklärt von *Paul Haupt*. Leipsic: J. C. Hinrichs'sche Buchhandlung. 1905. Pp. vii, 36.

Prof. Paul Haupt, the editor of the *Polychrome Bible*, of which so far all of the Hebrew texts but six volumes only of the English translation have

appeared, here offers a German translation of Koheleth or Ecclesiastes, being a new translation, quite literal and yet imitating the poetical original even in details.

Our readers, even those who are not Hebrew scholars, may know that Koheleth is one of the latest productions of the Biblical canon, written by some Hebrew thinker deeply imbued with Greek thought, and through his knowledge of Greek philosophy the author must have imbibed also much of Eastern philosophy. be it Buddhist or Brahmanic. The book became very popular among the Jews, so much so that the orthodox priests to whose views it was diametrically opposed were compelled to incorporate it into the canon. The pessimism was so natural, and the sentiments of the Koheleth appealed so strongly to the Jews of that age that the book could not be suppressed, but in order to conciliate the broad spirit of the Koheleth with the narrowness of Jewish orthodoxy, some orthodox redactor added to the author's philosophy some comments of his own which should give to these radical thoughts a gentler turn that would show them in the light of an orthodox interpretation.

Profesor Haupt has published those passages of Koheleth which form the original text in a connected order and relegates the priestly addition to footnotes. In this way we are enabled to grasp at once the original sense, and a little reflection teaches us why the domatic counter-statements cannot be ascribed to the same pen as the main body of the text.

The critical and historical notes are very terse but quite sufficient, and so the little book will not only be welcome to the specialist, but also to that large class of readers who take an interest in a rational study of the Bible.

P. C.

LAZARUS, DER BEGRÜNDER DER VÖLKERPSYCHOLOGIE. By *Dr. Alfred Leicht.* Leipsic: Dürr'sche Buchhandlung. 1904. Pp. 111. Price, Mark 1.20.

Professor Lazarus, the founder of *Völkerpsychologie*, i. e., folk psychology or psychology of nations, was born September 15, 1824, and, had he not died a short time ago, would this year have celebrated his eightieth birthday. In his honor the present booklet has been written by Dr. Alfred Leicht, who sets forth his merits as the founder of an important branch of science, the psychology of nations, and substantiates the claim by rehearsing the story of his life as well as his labors. The principles which Professor Lazarus has established are now generally acknowledged, but in his days he had to fight for their recognition. Even such a liberal and broad man as Eduard von Hartmann claims that the existence of a national psychology depended upon the existence of a national soul, and that the national soul was impossible except on the assumption of a metaphysical unity and substantiality of the collective spirit of a nation. Without such a substratum Hartmann

deemed the existence of a national soul impossible, but Lazarus insists that the assumption of a metaphysical soul unit is redundant and even inadmissible, and that the psychology of a nation exists by the very truth of a communal will. If the nations existed in metaphysical entities, humanity would throughout be cut up into several antagonistic beings, but, as a matter of fact, the only reason for antagonism among the nations originates by a contrast of their wills, not by a difference of soul substrata. The quality of things consists in their activity not in any metaphysical essence. What a thing in itself may be (except what it is in its activity) is an illegitimate question.

In order to characterise the significance of Lazarus's work we ought to consider the influence which he exercised upon the different domains of science. The recognition he found in theology possesses a greater significance in consideration of the fact that he was a Jew. His philosophical comprehension is sufficiently indicated by the honor which the University of Halle conferred upon him by renewing his Doctor's diploma. He stimulated historical research and his labors were especially suggestive to jurisprudence. A great honor was bestowed upon him by his co-religionists when the Hebrew Union College of Cincinnati introduced his ethical lectures for official reading and the faculty of this institution conferred upon him the honorary degree of Doctor of Divinity.

VÖLKERPSYCHOLOGIE. Eine Untersuchung der Entwicklungsgesetze von Sprache, Mythus und Sitte. By *Wilhelm Wundt.* Leipsic: Wilhelm Engelmann. 1904. Pp. xv, 667.

Professor Wundt, who has been so indefatigable in working out a philosophical system for all the several fields connected with psychology, and method, brings out a second edition of his *Völkerpsychologie,* which has been revised and enriched by several additions.. The first folio only lies before us containing Wundt's speculations on language in all its phases and formations, gesture, speech, and word formation. When the whole work lies before us we intend to give a more complete review of Wundt's views.

(The second volume just reached us when we were preparing the present number for publication.)

LEIBNIZENS APRIORISMUS IM VERHÄLTNIS ZU SEINER METAPHYSIC. By *Dr. A. Silberstein.* Berlin: Mayer & Müller. 1904.

The author has taken a Doctor's degree on this study of Leibnitz's apriorism, and he here republishes his dissertation, adding thereto his criticism of Dr. Ernst Cassirer with whose views concerning Leibnitz's system he does not agree. The main result of the pamphlet seems to be that Leibnitz has anticipated Kant more than is generally believed, and his standpoint may be characterised as "critical apriorism."